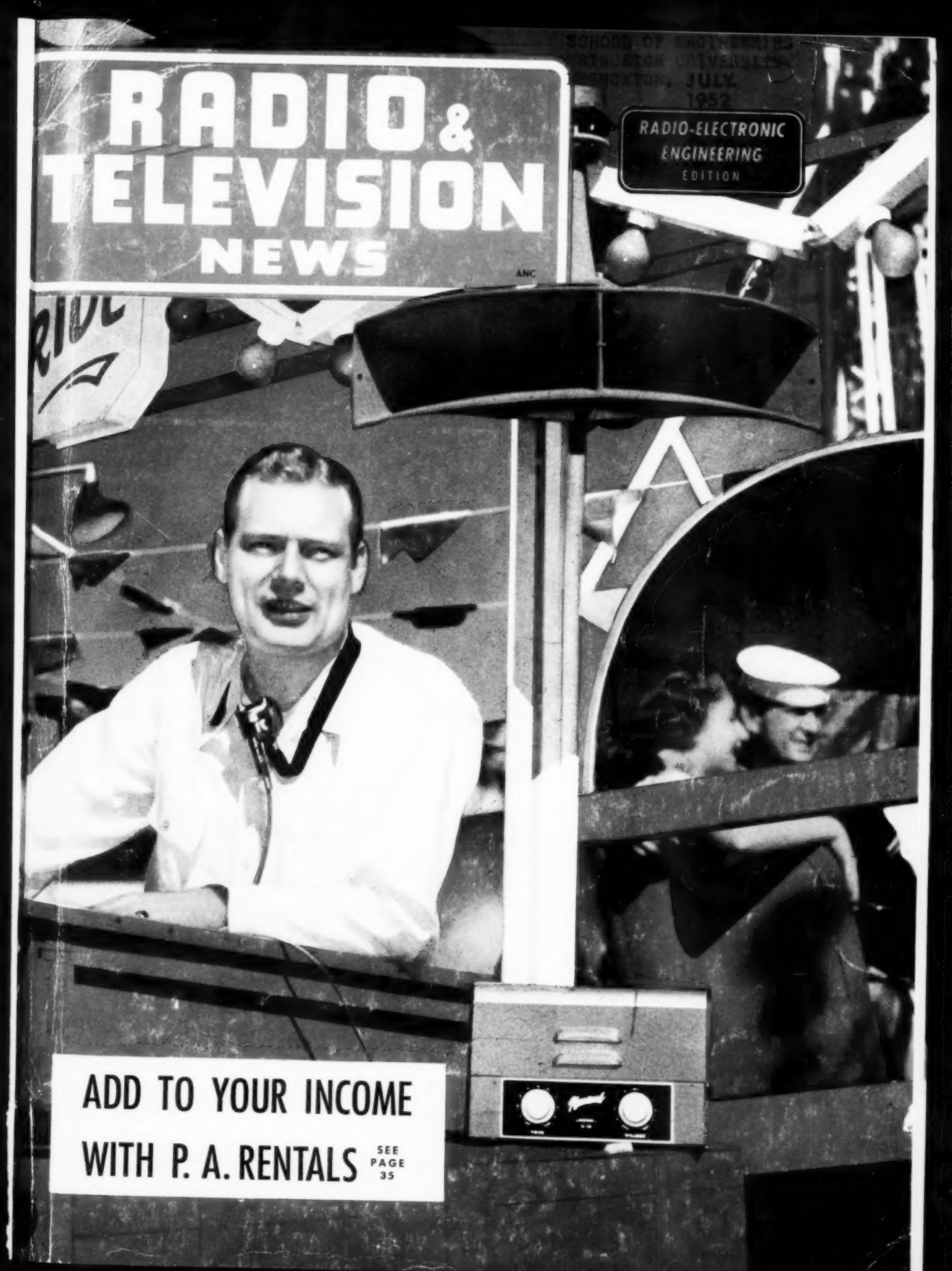
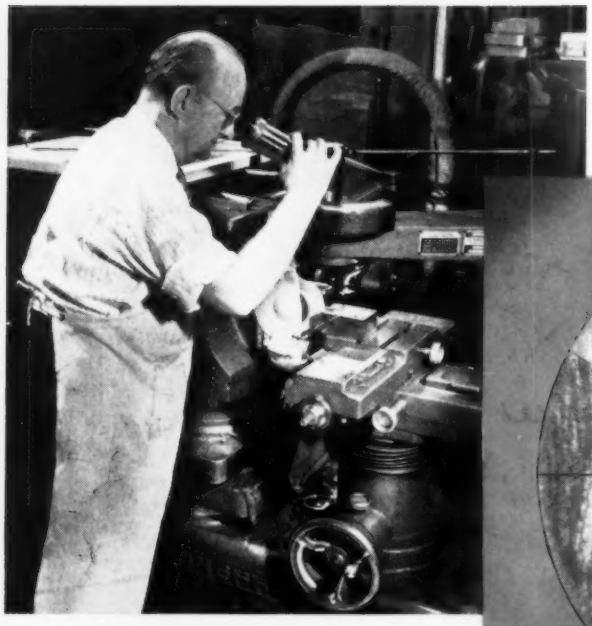
RADIO & TELEVISION NEWS

JULY
1952

RADIO-ELECTRONIC ENGINEERING EDITION



ADD TO YOUR INCOME WITH P. A. RENTALS SEE PAGE 35



1. The machine that grinds the die.

2. The die that forms the cathode sleeve.

3. The cathode sleeve that helps make the tube.

Take a look at quality being born

DIMENSIONAL ACCURACY of the cathode sleeve is a vital factor in providing top-quality tube performance. And cathode-sleeve accuracy begins with the forming die.

What you see above are the two sections of a typical cathode-sleeve forming die, just as it is viewed by the die maker through a 30-power microscope. The die is finished in a "profile grinder" which employs a 50-to-1 pantograph that traces a template and precisely guides the grinding operation. The result is a die accurate to better than one ten-thousandth of an inch!

Such painstaking precision finishing of dies used to stamp, punch, and form critical tube parts is one more step contributing to the top quality of RCA Tubes. In this way, RCA closely guards its own reputation for quality ... *and yours as well.*

With RCA Kinescopes, as well as with RCA Receiving Tubes, TOP-QUALITY CONTROL makes the difference.

RADIO CORPORATION of AMERICA
ELECTRON TUBES **HARRISON, N.J.** TMKS. (R)

You Practice COMMUNICATIONS

I send you parts to build this transmitter

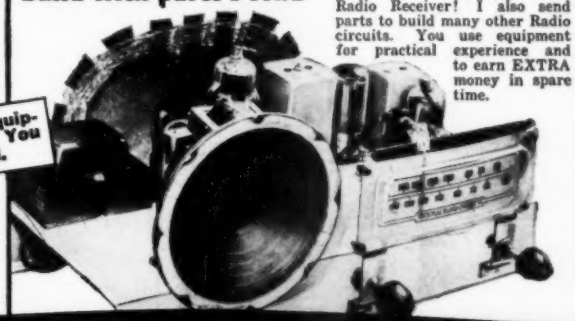
As part of my Communications Course you build this low power broadcasting transmitter, learn how to put a station "on the air," perform procedures demanded of Broadcast Station operators, make many tests.

This is just part of the equipment my students build. You keep all parts I send.

You Practice Radio SERVICING

on this modern radio you build with parts I send

As part of my Servicing Course, I send you the speaker, tubes, chassis, transformer, loop antenna, EVERYTHING you need to build this modern, powerful Radio Receiver! I also send parts to build many other Radio circuits. You use equipment for practical experience and to earn EXTRA money in spare time.



BE A RADIO-TELEVISION TECHNICIAN

NOW! Advanced Television Practice

New, special TV kits furnished to build high-definition SCOPE . . . RF OSCILLATOR with flyback power supply . . . complete TV set . . . many other units. You see pulse, trapezoidal, saw-tooth wave forms. Get valuable PRACTICAL EXPERIENCE locating and correcting TV troubles. Mail coupon for facts, pictures and prices!

Learn Servicing or Communications Practice at Home in Spare Time

J. E. SMITH, President
National Radio Institute

Do you want good pay, a job with a bright future and security? Would you like to have a profitable shop or store of your own? If so, find out how you can realize your ambition in the fast growing, prosperous RADIO-TELEVISION industry. Even without Television, the industry is bigger than ever before. 90 million home and auto Radios, 3100 Broadcasting Stations, expanding use of Aviation and Police Radio, Micro-wave Relay, Two-way Radio for buses, taxis, etc., are making opportunities for Servicing and Communications Technicians and FCC-Licensed Operators.

Television is TODAY'S Good Job Maker

In 1950, over 5,000,000 TV sets sold. By 1954, 25,000,000 TV sets estimated. Over 100 TV Stations now operating. Authorities predict 1,000 TV Stations. This means more jobs, good pay for qualified men all over the United States and Canada.

Many Make $10 Extra a Week in Spare Time

Keep your job while training. Hundreds of successful RADIO-TELEVISION TECHNICIANS I trained had no previous experience, some only a grammar school education. Learn Radio-Television principles from illustrated lessons. Get PRACTICAL EXPERIENCE—build valuable multitester—experiment with circuits common to Radio and Television. Keep all equipment. Many students make $5, $10 extra a week fixing neighbors' Radios in spare time. SPECIAL BOOKLETS start teaching you the day you enroll.

Send Now For 2 Books FREE—Mail Coupon

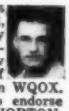
Send now for my FREE DOUBLE OFFER. You get actual Servicing lesson to show you how you learn at home. Also my 64-page book, "How to Be a Success in Radio-Television." Read what my graduates are doing, earning; see equipment you practice with at home. Send coupon in envelope or paste on postal. J. E. SMITH, President, Dept. 2GE, National Radio Institute, Washington 9, D. C. Our 39th Year.

I TRAINED THESE MEN

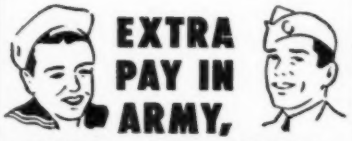
"I have been operating my own Servicing business. In two years I did $14,000 worth of business; net profit $6,850. Have one full time employee, an NRI student."—PHILLIP G. BROGAN, Louisville, Ky.

"Four years ago, I was a bookkeeper, with a hand-to-mouth salary. Now I am a Radio Engineer with a key station of the American Broadcasting Company network."—NORMAN H. WARD, Ridgefield Park, New Jersey.

"When halfway through the NRI course, I made $5 to $8 a week fixing sets in my spare time. Am now selling and installing Television sets and antennas."—E. J. STREITENBERGER, New Boston, O.



"My first job was operator with KDLR, obtained for me by your Graduate Service Dept. I am now Chief Engineer of Police Radio Station WQOX. I never hesitate to endorse NRI."—T. S. NORTON, Hamilton, Ohio.



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Knowing Radio, TV, Electronics can help you get extra rank, extra prestige, more interesting duty at pay up to several times a private's base pay. You are also prepared for good Radio-TV jobs upon leaving service. Mail Coupon TODAY.

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Many N.R.I. trained men start their own Radio-Television sales and service business without capital. Let me show you how you, too, can be your own boss, have a good income from your own shop. Send coupon for FREE book now!

Tested Way to Better Pay

Good for Both—FREE

MR. J. E. SMITH, President, Dept. 2GE
National Radio Institute, Washington 9, D. C.

Mail me Sample Lesson and 64-page Book about How to Win Success in Radio-Television. Both FREE. (No Salesman will call. Please write plainly.)

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Address.....

City.....Zone.....State.....

Approved for training under G. I. Bill

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CONTENTS

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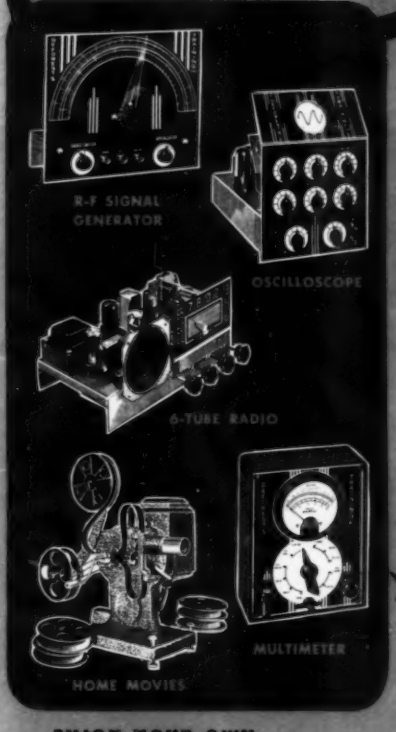
TELEVISION
RADIO - ELECTRONICS"

says

ART LINKLETTER!



Tells Why "People Are Funny" Program Relies On *D. T. I.* In Program Tie-Ups.

"Most people would be just as amazed as we are if they were privileged to see the remarkable results obtained through DeForest's Training, Inc.'s laboratory and home study training program," declared Art Linkletter, star of one of the nation's most popular radio network shows "People Are Funny."

"There have been many examples through the years," said Linkletter, "but let me cite you one to illustrate my point. One of our winning contestants who won a scholarship to D.T.I.'s Chicago laboratory was a wounded war veteran.

"This young man lost his left arm on the battlefield. Although he had no previous training, and had a hook for a left hand, he was prepared so effectively to be a television technician that after he completed his training he was able to establish his own profitable television and radio service shop. Imagine what this same training could do for the ambitious young man who is not impaired by the same handicap," said Linkletter.

"We must be careful of the quality of the gifts we give on our program. They must be tops. We also must watch the integrity of those who give them. Never once in all of the years that we have done business with DeForest's Training, Inc., have they ever failed to keep their word. Almost on all occasions their gifts far exceeded their obligations."

JACK DEMPSEY Tells Why

FORMER WORLD'S HEAVYWEIGHT CHAMPION

He's Proud To Be With *D. T. I.*

1. I have been greatly impressed with D.T.I.'s wonderful spirit of friendliness and sincere determination to help its students make good in Television-Radio-Electronics.
2. I admire its remarkable 20 year record of helping men build brighter futures.
3. I also admire the business policy of its management and the thoroughness of its large faculty of instructors.
4. Never have I heard young men praise a school as enthusiastically as do the students and graduates of D.T.I. They are its best boosters.

ENJOY YOUR OWN HOME LABORATORY

In addition to modern lessons, you get the PRACTICAL EXPERIENCE YOU NEED from working over 300 electronic experiments at home, including building and keeping all of the electronic equipment shown above. You also get the use of a motion picture projector and 16 reels of visual film to help you learn important points FASTER . . . EASIER at home. And upon completing training, you also have the optional privilege of building and keeping a 17-INCH TV SET at moderate added cost. Send for full facts. Mail coupon today!

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If subject to military service, the information we have for you should prove very helpful. Mail coupon today.

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Get BOTH of these publications FREE!

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2533 N. Ashland Ave., Chicago 14, Ill.

I would like your Opportunity News Bulletin showing "89 Ways to Earn Money in Television-Radio-Electronics"; also, the folder showing how I may prepare to get started in this thrilling field.

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RN-7-I

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for precision

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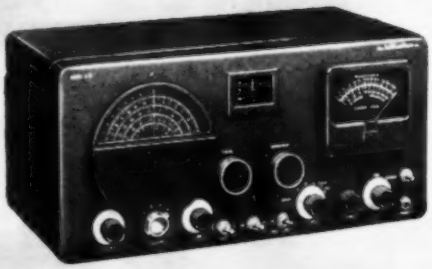
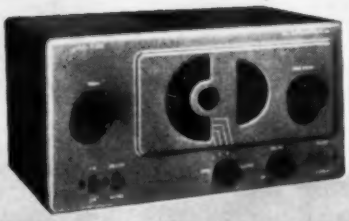
Everyone in radio knows that Hallicrafters is the Brand Name for "precision". Priced from $49.50 to $199.50, these four receivers have in commom the utmost performance to be found at each price level. This performance is achieved only through the matchless engineering and precision craftsmanship that is the tradition of Hallicrafters.

TOP HAM PERFORMANCE—The **SX-71**—Expressly designed for the advanced amateur, Communications Receiver SX-71 is a double conversion set, built-in NBFM limiter stage. 538 kc to 35 Mc, 46-56 Mc in 5 bands. Temperature comp.; voltage regulator. 1 r-f, 2 conversion, 3 i-f stages. Xtal. filter, 3-position selectivity. 115 V AC, 11 tubes, regulator, rectifier $199.50



"FIRST IN SELECTIVITY"—The **S-76**—Hallicrafters new communications receiver with amazing selectivity. Double conversion with 50 kc 2nd i-f. Giant 4-in. "S" meter. 540-1580 kc, 1.72-32 Mc in 4 bands. 1 r-f, 2 conversion, 2 i-f stages. 5 position selectivity. Phono input jack, 3 watt output. 115 V. AC 9 tubes, regulator, rectifier. $169.50

MEDIUM-PRICED COMMUNICATIONS RECEIVER—**S40B**—540 kc to 43 Mc in 4 bands. Electrical band spread. Temperature compensated. 1 r-f, 2 i-f. 3 watt output. Built-in speaker. 115 V AC only, 7 tubes, plus rectifier. (S-77—same as S-40B, for 115 V. AC or DC) $99.95



OVER HALF A MILLION SOLD!—The **S-38C**—Value-packed with performance, the S-38C is the outstanding low priced set on the market. 540 kc to 32 Mc in 4 bands. Maximum sensitivity per tube—far outperforms ordinary broadcast sets. Built-in speaker. 115 V. AC or DC. 4 tubes plus rectifier $49.50

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hallicrafters
"The Radio Man's Radio"

For the RECORD

BY THE EDITOR

OBSERVATIONS AT THE MAY SHOWS

SEVERAL innovations, designs, and techniques were introduced this year at the annual May Parts Show held in Chicago at the Conrad Hilton (formerly the Stevens) Hotel. One of the most spectacular was the huge *Electro-Voice* trailer truck, completely equipped with high fidelity sound systems for on-the-spot demonstrations in any city, town, or hamlet. The basic idea is to provide real sales cooperation between the manufacturer and his retail outlets in selling music systems to the masses. If this new medium is successful, and we are sure that it will be, more demonstration trucks will be added to increase the coverage on a nation-wide basis.

Audio topics, especially home music systems, continue to increase rapidly in popularity and acceptance. We saw more new audio components than any other product. It is unfortunate, we feel, that the annual Parts Show has become a "closed corporation," knowing that literally thousands of technicians, engineers, and others would greatly benefit from a visit to the vast exhibitions displayed at this important show.

An interesting demonstration was held in the towers of the hotel where through the combined efforts of *Jensen*, *Radio Craftsmen* and *Magnecord* binaural audio was demonstrated to a press conference. A special broadcast of high fidelity music was arranged and was transmitted over stations WGN (AM) and WGNB (FM) transmitters and picked up with *Craftsmen* tuners and amplifiers. Two special channels were employed, beginning with the placement of the FM microphone on one side of the orchestra and the AM microphone on the opposite side. At the receiving end, two identical three-way loudspeaker systems were set up with a separation between of approximately 20 feet. This was not the first time that we had heard a binaural demonstration and it was our feeling while listening to the program that the effect would have been far more realistic and startling if headphones had been employed as a comparative test to the loudspeakers. The use of headphones in the home, however, is not practical even though it does more accurately produce a binaural illusion. The sponsors are to be congratulated on this worthwhile endeavor.

Right on the heels of the Parts Show came the Audio Fair. Some 60 room displays were literally scattered over three huge floors of the world's largest hotel. The entire Fair could have been conveniently grouped on one floor. Two of the floors were littered with packing crates and debris remaining from the Parts Show and many of the exhibitors were practically lost in out-of-the-way corridors. With adequate planning and with proper promotion the 1952 Audio Fair could have been more of a success than it was. Many of the visitors (estimated at 3500) stated that until they heard the previous night's broadcast over WGN-WGNB they had no knowledge of the Audio Fair.

Many new audio products were displayed and demonstrated and several innovations appeared. Loudspeaker enclosures continued their bid for the audio spotlight. One trend is to employ multi-woofers (three 18-inch speakers) in addition to a mid-range horn and a tweeter. Another is to employ single speakers of from 5 to 8 inches in modified corner cabinets such as the *Klipsch*. Some remarkable reproduction was heard from many of these small, compact speaker systems. Space does not permit an analysis of all that we saw and heard. For the discriminating there was a wide choice of deluxe enclosures and reproducers providing the ultimate in reproduction.

Amplifiers, too, were seen in new and modified form. One new approach introduced by *Holl* (non-exhibiting) was the use of 16 triodes in push-pull parallel in the output stage. According to the designer, the plate resistance becomes 481 ohms per side. The use of 6SN7GTA's in push-pull parallel provides a mu of 20 and a transconductance of 83,000 micromhos for both halves.

Magnetic recorders were seen in ever-increasing numbers and priced to satisfy any listener's budget. It was interesting to observe the repackaging of many standard items. In particular were new preamplifier equalizers with etched metal enclosures and modern-type knobs. It is amazing in many cases how a "new look" will add to the appeal of a product.

Believing this to be true, RADIO & TELEVISION NEWS, beginning with the August issue, will have a completely new cover design. This publication has deviated but slightly from its original cover of July, 1919 and we think a new face is in order. The new design will increase the effective use of 4-color photography and its reproduction. Heretofore, as our readers well know, we have utilized the full dimensions of the cover for picture reproduction. By changing to a more compact design, we will eliminate the problem of having important subject matter run into the logo. We hope you will like our new look . . . . . O.R.

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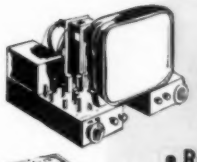

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To be given in G.E.'s great BSB*

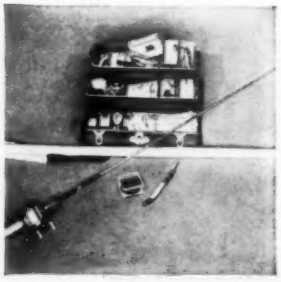
THREE BRAND-NEW

LOOK AT THESE BEAUTIFUL PRIZES YOU CAN WIN!

MEN'S CALENDAR WATCH, a handsome Benrus with gold expansion band, *plus* gold wind-proof cigarette lighter and matching gold cuff links and tie bar. All fitted in a smart and distinctive case.

LADIES' WRIST WATCH, a beautiful Benrus hinged-cuff "Embraceable" with safety chain; also, chic gold earrings and a stunning pendant-and-brooch combination. Can be a wonderful gift from *you*.

MATCHED GOLF IRONS, Wilson, with long-lasting nylon Wilson golf bag. Nos. 2, 5, 7, 9, and putter, Gene Sarazen Stroke-master model. Clubs, nationally distributed, can be filled in any time.



FISHING KIT, 27 items in a double-tray cork-lined tackle box. Gep glass casting rod, Green Hornet level-wind reel, fish rule and scale, Pflueger spoons and spinners, plugs, hooks and leaders.

SERVICE DEALERS!

Promotion Contest topped by

'52 DODGE TRUCKS!

***B. S. B.—Bigger Summer Business** tells the story! Increase your profits and walk off with a brand-new Dodge panel truck! General Electric's B. S. B. Contest offers you this double bonus.

The contest's loaded with 103 prizes! It's primed with new sales-getting helps for you, as shown at right. Contest starts now and ends August 15—weeks that are summer radio-TV check-up time for millions.

Yardstick of the contest will be how successfully you promote your own service business in terms of *planning, originality,* and *results.* G. E. will support you with special full-page tie-in ads in national magazines read by 35,000,000.

First prize to each of the three top winners will be a new '52 Dodge panel truck, handsomely lettered with your name and address.

100 other prizes—all big values, all mighty attractive!

ENTER NOW—HERE'S HOW!

● **Phone, write, or see your G-E tube distributor** for (1) descriptive folder that gives all details about the contest, (2) streamers, mailers, and other promotion items to help you win!

From the folder you will learn exactly what the contest covers, how to obtain and fill in your entry blank, how to make your promotion a success, what records to keep, and what type report to send in when the contest is over.

Five men of national prominence in the radio-TV service industry will serve as judges. Their names and positions are given in the contest folder. Act today! Profits plus a costly prize are waiting for you!

GENERAL ELECTRIC

161-1A3

The Nationally Advertised

RAYTHEON *Bonded Electronic Technician Program — with its cash-protected Bond, its code of Business ethics, and tremendous public appeal — builds business and profits by creating customer confidence in you . . .*

Better look into it today. This sales stimulating program costs you nothing if you can qualify.

*Ask your Raytheon Tube Distributor for complete information.

RIGHT...FOR SOUND AND SIGHT

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In quest of the "skeleton of speech"

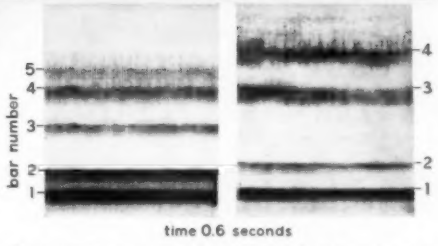
In the famous Quiet Room at Bell Laboratories, this young volunteer records speech for analysis. Scientists seek to isolate the frequencies and intensities which give meaning to words . . . stripping away non-essential parts of word sounds to get the basic "skeleton" of speech.

A child or an adult . . . a man or a woman . . . an American or an Englishman—all speak a certain word. Their voices differ greatly. Yet listeners understand the word at once. What are the common factors in speech which convey this information to the hearer's brain?

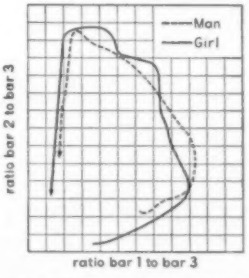
Bell scientists are searching for the key. Once discovered, it could lead to new electrical systems obedient in new ways to the spoken word, saving time and money in telephony.

Chief tool in the research is the sound spectrograph which Bell Telephone Laboratories developed to make speech visible. Many kinds of persons record their voices, each trying to duplicate an electrically produced "model" sound. While their voice patterns are studied, a parallel investigation is made of the way human vocal cords, mouth, nose and throat produce speech.

Thus, scientists at Bell Laboratories dig deeply into the fundamentals of the way people talk, so that tomorrow's telephone system may carry your voice still more efficiently—offering more value, keeping the cost low.



Spectrograms of young girl's voice (right) and man's voice making "uh" sound as in "up." Horizontal bars reveal frequencies in the vocal cavities at which energy is concentrated. The top of the picture is 6000 cycles per second. Pictures show how child's resonance bars are pitched higher than man's.



The word "five." Graph shows ratio of frequency of spectrogram bars. The solid line is for a girl and the dotted line is for a man. Note the similar patterns despite pitch differences. Human hearing extracts the speech sounds from this sort of pattern in the identification of words. Scientists aim at machines that can do the same.

Spot Radio News

★ ***Presenting latest information on the Radio Industry.***

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

THE GOLDEN ERA OF TV, which it was believed would be ushered in immediately with the release of that encyclopedic allocation document, may not burst on the horizon for several months now, because of discontent among applicants and possible law suits.

Strong evidence of this delay appeared in briefs filed by several prospective telecasters and particularly in a talk by the prexy of the Federal Communications Bar Association, Arthur Scharfeld, which noted that the new standards suffered from a basic flaw; the grant of permission to use maximum power anywhere . . . "regardless of the area in and around the community which should be served in the public interest." Declaring that the broad provision seems to have been included to simplify administration, the Washington legal specialist added that there appeared a legal question as to whether the Commissioners have not shelved their responsibility to act in the interest of the consumer. The fact that the new schedule did not require any of the existing stations to shift to the ultra-highs, was also viewed as a point which might be contested in the courts. The bar association head also stated that channels could not be assigned to any community, hereafter, unless a new rule was established, through extensive hearings. In this case, he reported, a prospective applicant may spend . . . "money, time, and energy in convincing the Commission that a certain channel should be reassigned, but there is no certainty that the applicant (whose efforts result in a channel reassignment) will be the one who gets the channel." Criticizing the setting of technical standards, as the allocations were being prepared, instead of prior, Scharfeld said that this procedure was unfair, robbing communities and telecasters of channels without notice.

One large midwestern set maker, who operates a TV station, also served notice on the Commission that it would argue the decision to change the allocation of its station from Channel 4 to 2. The antenna height provision also prompted some attorneys and stations to question the legality of the move.

Not only did some of the legal set and applicants strike away at the *Sixth Report,* removing the freeze, but the gentleman who wrote that biting dissent, Commissioner Robert Jones, also continued to display his anger. In a talk before the Ohio Association of Broadcasters Management Clinic in Columbus, Jones told his audience that he thought that the . . . "Commission has made grievous errors." In his opinion the decision to assume that . . . "every city and hamlet in the United States will use maximum powers and antenna heights . . ." was a basic fault. The Commission assumes, he continued, that . . . "Athens needs the same signal level as New York City. . . . They don't assume that Lima, Marion, and Mansfield have Empire State Buildings, but they do assume that they will build antennas 1000 feet high. . . . Accordingly, they have assigned the channels throughout the nation as if New York-sized facilities would occupy the channels in each median and small-sized city."

Lashing out at the assignments made in '45 to 158 of the largest metropolitan centers in the country, the Commissioner said that little or no thought had then been given to the efficient use of the channels. And today, he continued . . . "the Commission tries to justify all of these assignments . . . on the erroneous ground that v.h.f. channels have a greater potential to cover wide areas than the u.h.f. channels." This move, he felt, was like pulling a . . . "new rabbit out of the hat to substantiate the 1945 assignments to the largest cities . . . v.h.f can cover rural areas better than v.h.f. stations in the largest cities." In his opinion, this view was ". . . about as sensible as measuring the depth of a well by the length of the pump handle." He regarded this as . . . "fallacious reasoning from an engineering standpoint because either group of channels, v.h.f. or u.h.f., can be made to cover wider areas than the other."

Describing the . . . "hard and fast mileage separations (*and the resultant separation circles*) based on a New York-sized maximum power and antenna height for the smallest cities in the country . . ." as meaningless, the Commissioner said that the circles . . . "have no relationship to service areas . . ." or to the . . . "natural trading areas, or the areas of cultural influence of the cities included in the plan."

Continuing his pounding essay, Jones declared that the new plan . . . "cheats many cities out of having any local television facilities." He noted that the schedule . . . "excludes all local

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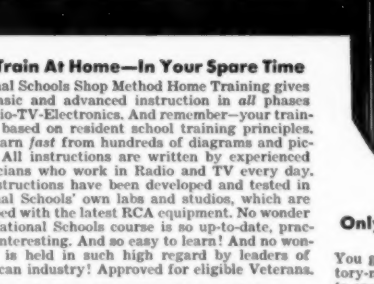

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television service from every city in the nation, except the favored 1274 included in the plan. . . . It provides 889 cities with just one local channel, notwithstanding the fact that the touchstone of the Communications Act is competition."

Commenting on the advertised advantages of the u.h.f. over man-made noise, the fighting Commissioner said that the areas where noise might be a problem and solved by the use of ultra-highs, have received few u.h.f. assignments. Instead, he said, the higher frequencies were assigned to rural areas, where the only noise to overcome might be that from . . . "an occasional milking machine, feed grinder, and farm tractor."

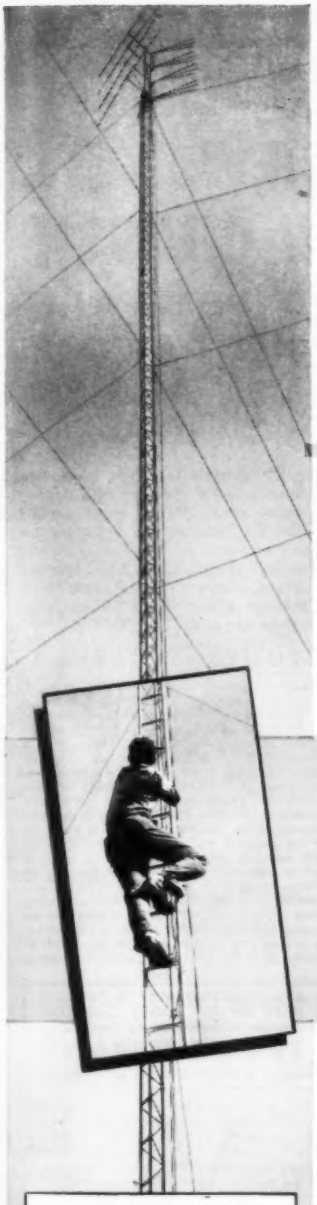
Noting that as . . . "long as . . . the order . . . remains a mere paper document, however bad, little harm is done. . . ." The Commissioner added that the harm will come . . . "as it is translated into brick for building, steel for towers, and all the elaborate electronic devices necessary to put the plan into operation." He saw the period immediately following the date of the order as the most critical . . . "because then if new and better methods should come to our attention, the mere blueprint or preliminary construction can be changed without undue distress. . . . The longer this plan stands and the more authorizations we grant under it, the more difficult and expensive it will be to change it. . . . And in that most important first year, the Commission has determined that it will refuse to consider any proposals for any change of any consequence."

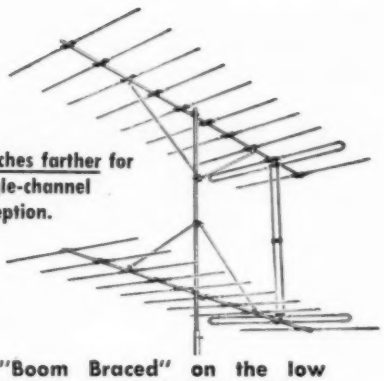
Network executives did not appear to be too distressed at the delay implications forecast by attorneys and engineers. They felt that it would not be long before TV will become a nationwide medium, which according to the prexy of *NBC* would result not only in . . . "improved programs . . ." but also . . . "technical advances." According to House committee chairman, Rep. Robert Crosser, the report of the FCC . . . "will prove to be good."

AS THE LEGALITY of the freeze lift was being debated, one of the Commissioners who approved the report, Rosel H. Hyde, currently serving as vice-chairman, was told by the President that he was being renominated for a seven-year term. While at this writing, the official sanction of the appointment by the Senate Interstate and Foreign Commerce Committee had not been made, there was little doubt that the veteran member of the Commission would meet any opposition. In fact, it was said that his appointment would receive unanimous approval, since he has had a commendable record not only as a Commissioner, but as a member of the legal staff, and even as an aide on the early Federal Radio Commission.

The renaming episode prompted many to comment on the plans of Hyde's former fellow Commissioner

(Continued on page 72)





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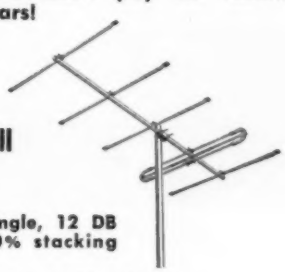
- You don't pay for stacking bars!



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- Over 9 DB single, 12 DB stacked (100% stacking gain!)
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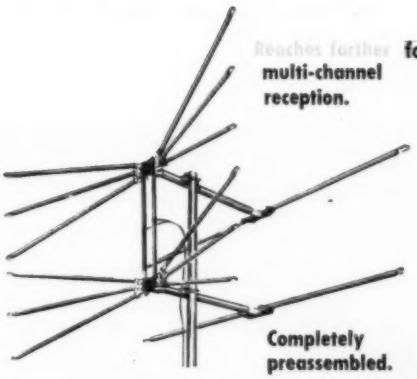

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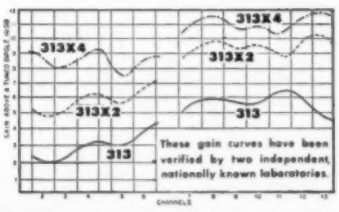

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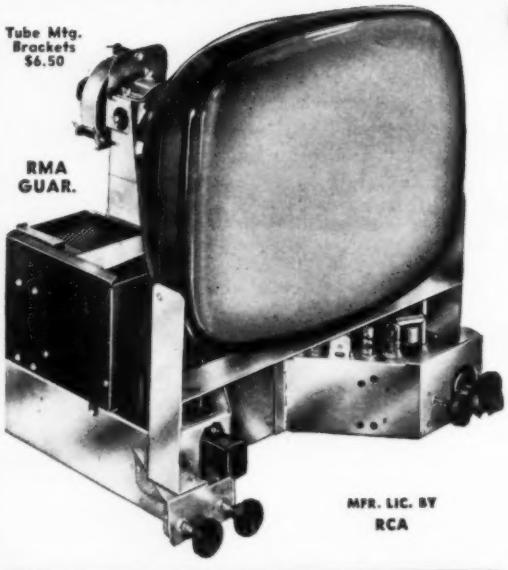

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• RCA 6" Accordion Cone Speaker	4.95
• Resistors, 100 Asst., ½ to 2w $2.49; 1000 Asstd	22.00
• 300 OHM TV wire, 100 ft., $1.89; 1,000 ft	17.95
• "Now You Can Fix Your Own TV Set" (Book)	1.00
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• Standard Coil Cascode Tuner	24.95
• Regency Booster, Mdl. DB520	19.11
• 5 Watt AC Amplifier Kit	9.95
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NEW HEAVY-DUTY TV HIGH-VOLTAGE RECTIFIER CAN TAKE IT!

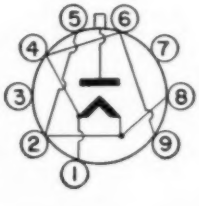
TV high-voltage rectifiers take a beating: Terrific variations occur in applied filament voltage . . . 0.8 to 2.4 volts! Sudden arcs in the rectifying system place destructive electromechanical stresses on the filament. And the increasingly larger TV picture tubes demand peak emission and peak inverse voltage simultaneously. The new CBS-Hytron 1AX2 was especially designed to take such rough treatment and come up smiling.

1AX2 DATA

The CBS-Hytron 1AX2 is a compact, 9-pin miniature TV pulse rectifier. Plate is brought out to top cap and filament is oxide-coated. Absolute maximum ratings are: peak inverse plate voltage, 25,000 volts; d-c load current, 1.0 ma.; and steady-state peak plate current, 11.0 ma.

Typical Operation — TV Pulse Rectifier

Filament voltage	1.4 v ± 10%
Filament current	650 ma
Positive-pulse plate voltage	20,000 v
Negative-pulse plate voltage	5,000 v
Peak inverse plate voltage	25,000 v
D-c output voltage	20,000 v
D-c load current	300 μa



BOTTOM VIEW OF SOCKET

ADVANTAGES OF NEW CBS-HYTRON 1AX2

1. Rugged, high-wattage filament of CBS-Hytron 1AX2 has adequate peak emission for the new, larger TV picture tubes. 1AX2 may be run simultaneously at both its peak inverse voltage and maximum d-c current.
2. Higher load of 1AX2 filament on transformer tends to regulate filament voltage. Eliminates need for limiting resistor. Yet lower plate-to-filament capacitance (0.7 μμf) of 1AX2 prevents loss of high voltage.
3. Insulated tension bar (patent applied for) through center of 1AX2 coiled filament limits destructive movement of filament by electromechanical stresses.
4. Filament of 1AX2 is located in base and shielded to eliminate bombardment of cool ends of filament by gas molecules.
5. An overloaded 1X2A may be replaced with its big brother, the CBS-Hytron 1AX2, by simply removing the limiting resistor. In rare cases, it may be necessary to add another turn to the secondary of the filament transformer to obtain the required 1.4 volts for the 1AX2.

MANUFACTURERS OF RECEIVING TUBES SINCE 1921
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CBS HYTRON RADIO TUBES

MAIN OFFICE: SALEM, MASSACHUSETTS

Within the INDUSTRY

NORMAN FYLER has been appointed supervisor of development TV picture tubes for *Hytron Radio & Electronics Co.*, a division of *Columbia Broadcasting System, Inc.* The appointment follows the announcement of an organization change in *Hytron's* picture tube manufacturing division.

Mr. Fyler was formerly associated with *Sarkes Tarzian, Inc.* and *RCA's* Princeton Laboratories. His group will carry on advanced development that will supplement the work of the Factory Engineering Department which continues under the supervision of A. Harcher, chief factory engineer.

* * *

SYLVANIA ELECTRIC PRODUCTS INC. is negotiating a lease for a 50,000 square foot factory building to be erected in the York, Pa. area. The new plant will be used for the fabrication of metal parts and will be operated as a unit of the company's Parts Division, which has headquarters in Warren, Pa. . . . **TELEVISION UTILITIES CORP.**, manufacturers of video monitoring equipment, has moved to new and larger quarters at 1315 Jericho Turnpike, New Hyde Park, Long Island. The move was necessitated by the increased demand for the company's products . . . **LEWIS AND KAUFMAN, INC.**, manufacturers of the *Los Gatos* brand of electron tubes, has added 6400 square feet of production space with the acquisition of a long-term lease on a hangar-type skating rink building at 657 University Avenue, Los Gatos, California . . . **NEWARK ELECTRIC COMPANY** has opened a new and larger store at 223 West Madison Street in Chicago. The new quarters permit the company to warehouse its entire stock under a single roof while providing a more efficient selling area for customers. The new facilities include demonstration rooms as well as the sales areas . . . **HERMAN RADIO SUPPLY CO.** of Miami has moved to new and less congested quarters at 23rd Street and 14th Avenue, Northwest. The new distributing outlet will be operated "super-market" style to speed customers' orders while the new location will provide better parking facilities for those who do business with the firm . . . **COOK RESEARCH LABORATORIES** has doubled its former space by building new and larger quarters at 8100 Monticello Avenue, Skokie, Illinois . . . A contract for the construction of the new 15,600 square foot **ELECTRIC REGULATOR CORPORATION** plant in Norwalk, Conn. has been placed, with completion planned for August of this year. The new building will be used for the production of the company's electric circuit controller, the "Regohm."

* * *

DAVID SARNOFF, chairman of the board of directors of *Radio Corporation of America*, has been elected as the first recipient of the RTMA's Annual Award for outstanding contributions to the advancement of the radio-television industry, by the Association's Board of Directors. The award was presented to Mr. Sarnoff at the RTMA industry banquet held June 26 in Chicago in connection with the organization's annual convention.

The award was established by the RTMA Board of Directors in February and will be made annually to the person, company, or organization which the RTMA directors consider has performed an outstanding service for the industry.

* * *

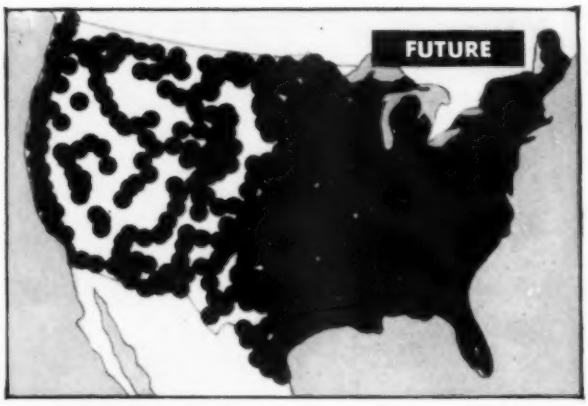
J. T. McALLISTER has been named factory sales manager for *Hoffman Sales Corp.* in Los Angeles.

A graduate of the Milwaukee School of Engineering, Mr. McAllister spent 3½ years in the navy after which he was employed at the Naval Research Laboratory in Washington, D. C. as an engineer specializing in high frequency equipment.

He joins *Hoffman* after serving as manager of *RCA's* factory-operated service organization in Hollywood for 5½ years. In his new position, he will supervise one of the largest service departments in the Los Angeles area.

* * *

BERT KOHL has been named assistant sales manager and **WILLIAM P. LEVISON, JR.** has been appointed advertising manager for *Pyramid Electric Company*, New Jersey condenser manufacturer . . . **ARTHUR E. WELCH** is the new assistant general manager of the radio-television and broadcast receiver division at *Bendix*. He was formerly national merchandising manager for *Raytheon Manufacturing Company*, a post he relinquished recently to accept his new position . . . **A. W. KEEN** has been appointed manager of application coordination at *Sylvania Electric Products Inc.* He will head a new department whose function it will be to investigate the advanced applications of the electronic products manufactured by several of the company's divisions . . . **ARTHUR F. MERRIGAN**, formerly



FUTURE—*How new TV stations are expected to cover the nation.*
PRESENT—*Chart shows extent of current coverage.*

Cash in on this Great Opportunity

. . . for good-pay jobs in TV SERVICING

YES, thousands of opportunities are going begging right now for good-pay jobs in TV Servicing.

The lifting of the "freeze" on new television stations clears the way for the expansion of the industry for 2,053 new stations, in 1,291 communities in the United States, its territories and possessions. There are only 108 stations telecasting now.

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Big shortage of TV Technicians creates opportunities—NOW

Industry experts have estimated over 130,000 experienced TV technicians will be needed for the installation, trouble-shooting and repairing of television receivers in use by 1955. There are fewer than 50,000 fully trained TV service technicians available today. What an opportunity this creates for you!

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RCA Institutes home study course trains you in your spare time

If you are associated with the radio-electronics industry, with no experience in TV servicing, the addition of the RCA Institutes Home Study Course in TV Servicing to your present experience will quickly qualify you to step out and grasp the good jobs now open in television.

The RCA Institutes course gives you a sound knowledge of television fundamentals . . . intensive practical instruction on the proper maintenance and servicing of TV receiver circuits . . . teaches you the "short cuts" on TV installation and trouble-shooting. Learn TV servicing (based on actual experience of hundreds of skilled technicians) from RCA engineers and experienced instructors—pioneers and leaders in radio, television and electronic developments.

RCA Institutes home study course planned to your needs

You keep your present job. In your spare time, you study at home. You learn "How-to-do-it" techniques with "How-it-works" information in easy-to-study lessons prepared in ten units. Cost of RCA Home Study Course in Television Servicing has been cut to a minimum—as a service to the industry. You pay for the course on a "pay-as-you-learn" unit lesson basis. You receive an RCA Institutes certificate upon completion of the course. The RCA Institutes Home Study Course in Television Servicing is approved by leading servicemen's associations.

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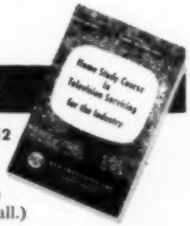
RCA Institutes conducts a resident school in New York City offering day and evening courses in Radio and TV Servicing, Radio Code and Radio Operating, Radio Broadcasting, Advanced Technology. Write for free catalog on resident courses.



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A SERVICE OF RADIO CORPORATION of AMERICA
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associated with *Remington Rand*, has been named president of *Wirt Company*, Philadelphia manufacturers of electrical and electronic components. He succeeds **PAUL G. DURYEA** who has retired . . . **ROBERT I. GAINES** has been promoted to the post of export manager for the newly-created International Division of *Allen B. Du Mont Laboratories, Inc.* He will supervise all export activities of the company . . . **GEORGE J. SCHAD** and **ROBERT C. OVERSTREET**, treasurer and secretary respectively, have been named vice-presidents of *Tinnerman Products, Inc.* Both men will continue to serve the company in their former capacities in addition to assuming the duties of vice-presidents . . . **WILLIAM P. STRATTON** is the new manager of contract administration and director of advertising and sales promotion for *Transco Products, Inc.* He was formerly associated with *Kaiser Aluminum and Chemical Sales, Inc.* and *Daystrom, Inc.* . . . *Lenkurt Electric Company* has named two new vice-presidents, **PHILIPS B. PATTON** and **GEORGE F. KOTH.** Mr. Patton will continue his present administrative duties as commercial manager in addition to his new duties as a vice-president while Mr. Koth will continue as works manager . . . *Berlant Associates*, of Los Angeles has named **DAVE GURY** to the post of national sales manager. The company manufactures "Concertone" magnetic tape recorders . . . **J. T. CATALDO** is the new assistant general manager of *International Rectifier Corp.* of El Segundo, California. He was associated with the Signal Corps Engineering Laboratories at Fort Monmouth prior to joining the rectifier firm . . . **SAM KAPLAN**, vice-president and controller of *Zenith Radio Corporation*, has been elected treasurer of the corporation. He has been with the firm for over twenty-five years . . . **FRED ABRAMS** has been named to the post of assistant to the treasurer of *Emerson Radio and Phonograph Corporation*. His former position as general manager of the Parts Sales-Service Division is being filled by **FLOYD MAKSTEIN** who has been with the firm since 1945.

* * *

JAMES R. BUTLER has been named sales promotion manager for *Belmont Radio Corporation*, manufacturer of *Raytheon* television and radio receivers.

He joined the company in March of this year after having been associated with the *Free Sewing Machine Co.* as national sales promotion manager. He has also been associated with *Westinghouse Electric Corporation*, the *Norge Division* of the *Borg-Warner Corporation*, and *Prest-O-Lite Storage Battery Co.*

Mr. Butler, who will make his headquarters in Chicago, spent six years in the armed forces. —30—

RANCH RADIO

George Lazear, executive manager of the Wyoming Hereford Ranch, "rides range" in a V-8 equipped with a mobile radio unit.

By STAN JOHNSON, W0LBV

Isolation in the West is going the way of the buffalo, thanks to modern two-way radio gear.

THE rancher stood by a gate—watching a bank of tumbling, black clouds building up in the west. A few feet from him, a combine stood in the wheat field—idle.

The man's eyes were dark with worry. For the black clouds were hail clouds. In a few minutes, they might spill hail down onto the ripe grain. Should this happen, the year's crop—worth many thousands of dollars—would be pounded into the ground.

The rancher's eyes brightened as he saw a pick-up truck racing towards him down the rocky, dusty road. The truck should be bringing a V-belt—the part needed to get the combine back into the field cutting grain again.

A young man, a member of the crew traveling with the combine, jumped from the truck. "They didn't have the belt, or anything close to it. I'll have to go get one. Should I go to LaJunta, or Trinidad?"

The rancher's face became grim. LaJunta was 65 miles away. Trinidad 75 miles.

"At least we could phone ahead, and find out which town has the belt," said the young man.

"That's the trouble out here," the rancher replied, wearily. "There's no telephone, no telegraph, no way on earth to call."

He looked anxiously at the sky. "Well, we will have to do the best we can. You go to Trinidad. I'll go to LaJunta and Springfield. Mebbe one of us can find a belt in time."

Episodes like this were all in a day's work in Kim, Colorado, until recently. For Kim, by some accident of nature, sits all by itself, near the center of an oasis of rich wheat and cattle land—in the midst of a region which is almost a desert. A desert—except when sudden storms make the few roads, dusty and rough in dry weather, virtually impassable.

These roads, until recently, were the only contact between the town—and the cattle and wheat ranches surrounding it—and the outside world. Radio has changed the picture completely—and back of that change is a story of a community and a big corporation teaming up to provide a desperately needed service.

Years ago, Kim did have a telephone system of sorts—a single wire local system connecting a few subscribers in Kim with the office of a little independent company in Branson, New Mexico. But the system worked so poorly even for local calls that it was finally abandoned. The people in Kim hoped that some miracle would put a main telephone line within striking distance of their town. But no line came through. Kim remained isolated.

Periodically, through the years, Kim people discussed with representatives of the *Mountain States Telephone and Telegraph Company* the possibility of running lines to hook Kim into the *Bell System*. But the problem was always the same: cost. For example, one possibility was to run a line to the county seat, Trinidad, along 75 miles of county road. Simply running the line would take a lot of money. And the area is so beset by fierce electrical storms during the summer that maintenance was certain to be an extremely tough problem.

Fortunately for Kim, the company's commercial representative, A. H. Stewart, and executives in the engineering and plant departments did not give up easily—for they knew how badly the service was needed. They decided that the one chance was to forget about using a telephone line and substitute radio.

By radio, the distance would be shorter—about 65 miles. But since the circuit would have to use high frequency FM radio (nobody wants static crashes mixed up with a telephone conversation) the technical problems were formidable. For, as any ham knows, crossing 65 miles of country with a signal which is the equivalent of "S-9 plus" at both ends, any time of the day or night, winter or summer, takes some real doing.

Preliminary tests, with temporary set-ups at both ends, proved that the radio link was possible, *providing* the antennas were really put up in the air.

At the Trinidad end, the engineers had one thing in their favor: Simpson's Rest (known to local lovers as Passion Point!). Simpson's Rest, named for George Simpson, pioneer and Indian scout, rises approximately 400 feet above the city—right at the edge of town—close enough to make it entirely practical to build an antenna system and transmitting unit upon it and connect the whole thing to the telephone exchange in Trinidad.

Out at Kim, the country is billiard-table flat, although there is some rough country between the two cities. So at Kim, the antenna system had to be up on some kind of structure. The answer proved to be monster 90 foot telephone poles, which had to be trucked nearly 300 miles from Denver, over routes worked out with the cooperation of the highway department and the state police.

While the radio installations were being made, the farmers and ranchers in the Kim area, working under the supervision of telephone company men,

Rancher W. Tom Rose finds that a telephone system, made practical by a v.h.f. radio circuit, has completely changed the living habits of the isolated community in which he lives.

Owen Oslund, office manager at the Wyoming Hereford Ranch, can contact vehicles out on the range by means of this fixed station transmitter-receiver and the mobile units in the trucks.

put up poles and strung the wires needed to tie the ranches together into a telephone system. By donating their labor, Kim men kept costs down. Yet the finished system, inspected by telephone company experts, compares favorably with *Bell System* standards. The completed exchange is one of the largest in area—if not *the* largest—in the world, covering 1152 square miles to reach just 88 subscribers. As a comparison, the New York City exchange, with millions of subscribers, is comprised of only 320 square miles.

At Kim, the exchange is strictly a cooperative venture, owned and operated by Kim people. The sheriff, for example, doubles in brass as maintenance chief. In operation, the system is much like any other up-to-the-minute dial system. In making a long distance call on one of the phones, the average user would have no idea that radio was being used to push the signal across 65 miles of space. But here is what actually happens when a call is made.

Dialing "O" on a Kim telephone turns on the carrier on one of the transmitters. This is received in Trinidad on one of the FM receivers. The incoming signal operates a relay, which in turn lights a light on the switchboard in the Trinidad office. The telephone operator answers the call, and then goes ahead and patches the call into the long distance telephone system in the usual manner.

The procedure (as this article is written) for placing a call to Kim is somewhat different. The operator in Trinidad rings the Kim operator by means of the radio circuit. The Kim operator completes the call, after learning which subscriber is wanted. Dial equipment, Trinidad to Kim, is now being installed.

The FCC assigned four frequencies in the 152 to 158 megacycle range for the Kim-Trinidad link. This makes possible two channels, which means, of course, that it is possible for two conversations to be going on simultaneously. Since telephone conversations are "duplex"—not monologues like ham conversations or most other commercial radio contacts—two transmitters and two receivers are in operation for *each* channel.

Surprisingly little power has been used for the link, the transmitters being 50 watt units mounted in metal boxes at the foot of the telephone poles carrying the five-element yagi antennas. At the Trinidad end, it is planned to replace the transmitters with larger 250 watt units, to give extra power during the thunderstorm season, when the noise level becomes higher than the telephone company regards as being up to its high standards for telephone conversations. But the system has been working—and very well—with the 50 watt units.

What does it mean to a community, completely isolated from the rest of the world as far as fast communication is concerned, to have a modern system?

"It means just about everything in the world," says W. Tom Rose, rancher and president of the local school board. "We actually didn't know what we were missing—or how much simpler life could be. You know," he smiled, "I still catch myself hopping into the pick-up, starting off someplace—then remembering that now all I have to do is to make a phone call."

North and east of Kim is another community in which radio is changing the lives of the people who live there: Cheyenne Wells. Up here the problem is somewhat different from that at Kim. Cheyenne Wells is tied in by phone line to the *Bell System,* but some of the ranches in the area are so far apart that linking them by rural phone lines had never seemed practical. So the telephone company decided to put in a strictly experimental hook-up in which eight ranches would be tied to the exchange in Cheyenne Wells through radio circuits—without the usual poles and wires.

As finally worked out, four of the ranches were hooked up to a fifth with telephone lines—and then this ranch, and three others, were each equipped with transmitting and receiving units. The equipment is housed in a cabinet roughly the size of a console radio. Power comes from vibrator packs operating off 32 volt farm plants—kept charged by windchargers.

The receivers must be "on" all of the time, so the vibrators must be running constantly. Even so, by modifying them slightly (by removing the cases to get rid of the rubber damping material) they often run for a year.

The equipment is checked every 3 months—with frequency checks every 6 months.

The system used is necessarily quite complex to avoid two transmitters operating on the same frequency at the same time—and still not require use of a large number of frequencies. Actually, the system uses only three frequencies. Here's how it works:

Let's start with a call originating from one of the ranches, the Klines, who are calling to the Blackwelders on another ranch.

Lifting the telephone at the Klines' home turns on the transmitter, sending an unmodulated carrier (49.0 megacycles) to a receiver in Cheyenne Wells, where it is picked up by a receiver, causing a light to appear on the board. The operator receives the call and instructs the party at the Klines to hang up while the Blackwelders are being rung.

To ring, the 44.2 megacycle transmitter at Cheyenne Wells is pulsed at a 20-cycle rate. This pulsed signal is picked up by all receivers in the system and the signal, through a relay, causes all of the telephones on the system to ring, as on a "party" line.

When the Blackwelders, in response

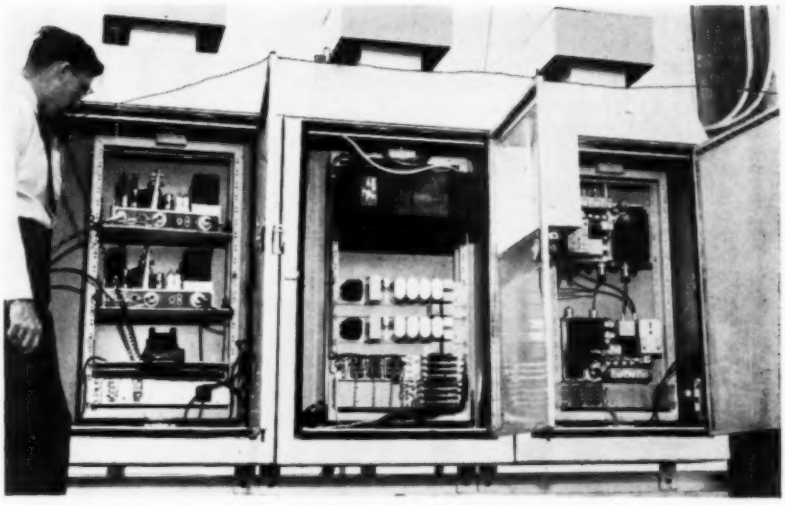
to their ring (for example, two longs and two shorts) take down their telephone handset, another relay hook-up, actuated by the receiver, shifts the frequency of their transmitter from 49.0 megacycles to 49.2 megacycles. This is necessary to avoid heterodynes with the Kline transmitter, which is already on the air.

The signals going back from the Blackwelders is picked up at the switchboard—as is the signal from the Klines—and *both* are fed to the same transmitter, which operates on 44.2 megacycles, through a mixing circuit known to telephone men as a "hybrid." This "hybrid" also makes it possible to tie in the switchboard operator's voice—so that either of the subscribers, or the operator, can talk over the single transmitter at the exchange.

Of course, only one conversation can go on at a time among the 8 subscribers, otherwise there will be heterodynes.

From the standpoint of the subscribers at Cheyenne Wells the radio hook-up is a complete success and the telephone system has become a part of day-to-day living. But the telephone company still regards the system as highly experimental and not likely to be duplicated anywhere else for some time. Technically it works like a charm. But still to be overcome are problems of economics—each of the radio-equipped ranches is a radio broadcasting station, with complex and expensive receiving gear thrown in to boot. The sheer cost of such installations is certain to limit their use until such time as it is possible to cut down on the size and cost of the equipment needed to do the job.

(*Continued on page* 128)



Transmitters and receivers at Trinidad, Colorado, part of the radio setup which links the Trinidad exchange of Mountain States Telephone and Telegraph Company with Kim, Colorado, 65 miles away. Marvin Runner is responsible for this gear.

Five element yagi arrays are used for the Trinidad-Kim radio link—one of the longest "one shot" commercial radio hook-ups on v.h.f. operating in the United States.

At Kim, Colorado, the yagi arrays are supported atop 90-foot telephone poles. Moving these poles from Denver required the combined efforts of Mountain States Tel. & Tel., the highway department, and police.

A wheat rancher and his son inspect one of the combination receiver-transmitters used in the Cheyenne Wells hook-up.

ELIMINATING OUTSIDE TVI

By

JOHN B. LEDBETTER

Engineer, WKRC-TV

Fig. 1. One form of oscillator radiation interference characterized by horizontal lines.

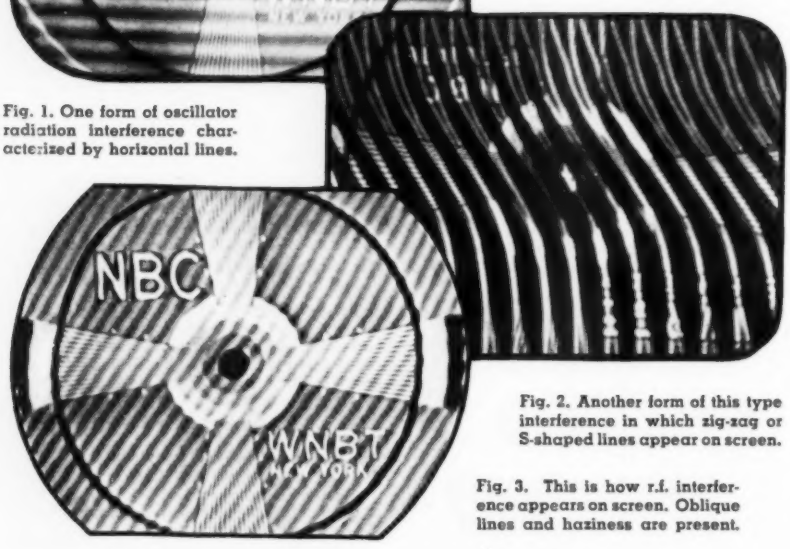


Fig. 2. Another form of this type interference in which zig-zag or S-shaped lines appear on screen.

Fig. 3. This is how r.f. interference appears on screen. Oblique lines and haziness are present.

Some practical hints for combating a familiar but rapidly-increasing television servicing problem.

INTERFERENCE from outside sources usually enters the receiver through the antenna, lead-in, or a.c. power line. (In a few cases it can be picked up by or may actually originate from a defective or unshielded part in the set.) Identification usually is simple, while locating the source may be more difficult. In some cases, elimination will be surprisingly easy; in others you will have to use ingenuity, unlimited patience, and a combination of "cut-and-try" remedies. Then, too, there are a few types of interference (severe oscillator radiation, etc.) which cannot be eliminated by *any* present method.

The following hints and corrective measures will produce satisfactory results in the majority of cases. Their use or listing may suggest other remedies which are equally, if not more, effective.

TYPE: Oscillator Radiation.

EFFECT: Black horizontal lines or bars, zig-zag or "S"-shaped lines, diagonal lines, "pinwheels," "chicken-wire," mesh or herringbone patterns (see Figs. 1 through 5). Strong interference of this type may completely obliterate the picture. (Usually, only one local channel is affected.)

SOURCE: Nearby TV receiver. (Interference may vary when sets warm up or when the fine-tuning control on either is adjusted.)

REASON: The local oscillator frequency in receivers using a 25 mc. i.f. falls within the TV band. When the receiver is tuned to Channels 2, 3, 7 or 9, its oscillator will beat or fall within the video frequency of Channels 5, 6, 11, 12, or 13. If the oscillator stage is not completely shielded or isolated from the r.f. and antenna circuits, it is capable of radiating over a considerable distance (actually up to several hundred feet). (The RTMA-suggested 40-45 mc. i.f. eliminates oscillator radiation problems within the v.h.f. band but will possibly introduce *another* problem by subjecting the receiver to possible interference from the new proposed high-power police stations assigned to the 45 mc. band.)

REMEDIES: Oscillator radiation interference often can be reduced or eliminated by one of the following methods. Experimenting may be necessary since all receivers will not react the same.

1. *Install a booster at the offending receiver.* This is the most effective since it isolates the radiating oscillator from the antenna circuit, but it requires full cooperation from the owner of the interfering set. In many cases this will be difficult to obtain even if the complainant offers to pay for the booster. Diplomacy and a satisfactory explanation of the trouble will be necessary.

2. *Shield the offending receiver.* This is *sometimes* effective but also requires the owner's cooperation. Satisfactory results can often be obtained by lining the offending set's cabinet with copper screen or aluminum foil *(Reynolds Wrap)* and grounding it to the chassis. A good common antenna-receiver ground system is required here (improper or inefficient grounding may make the interference *worse*).

3. *Readjust the antenna.* Reorienting either antenna, even slightly, may shift the affected receiver out of the path of the radiated signal. Try moving either or both receivers slightly or relocate one in another part of the room (with the owners' permission).

4. *Ground the receiver.* This is recommended in *all* cases unless the chassis was not designed for grounding. A few (*i.e.*, those with series-filament circuits) must be kept above ground. Check the schematic or consult the distributor if you are not familiar with the circuit or have reasonable doubts.

5. *Install a high-gain, highly-directional antenna.* The yagi, "In-Line," "Circle-X," "Double-V" and "Paracon" types are very good in rejecting radiation from the back and sides of the antenna. The conical usually is not so good from this standpoint because of its four small pickup lobes toward the sides. In a number of local cases, excellent results have been obtained with an *inside* conical or an inside loop, either as the sole antenna or in parallel with the regular outside unit. In one particular case, the inside conical (in parallel with an outside conical) completely eliminated all traces of oscillator interference where every other method had failed. (This probably represents an isolated condition, but similar results have been obtained in other cases. A condition of perfect phasing appears to be the answer.)

6. *Shift the i.f. frequency of the offending set.* In a few cases, realigning the interfering receiver's i.f. about 1

kc. lower has corrected the trouble. (This is not practical on the majority of receivers because it affects bandwidth, sensitivity, and stability to some extent.) Such a change also requires cooperation of the owner and may place you in a ticklish position if trouble should later develop in the set.

7. *Install a wavetrap across the antenna terminals.* A ¼ wavelength open stub or high-pass filter may work if the interference is not too strong. Otherwise, part or all of the desired signal may be eliminated along with the radiated signal.

TYPE: Electrical Interference.

EFFECT: Black and white streaks (Figs. 6 and 7); may be accompanied by flashes or varying brightness, picture tearing, or momentary loss of sync.

SOURCES: Automobile and truck ignition systems. Smoke precipitators. Neon signs. Electric machinery (power saws, generators, lathes, drill presses, pumps, etc.). Electrical appliances (food mixers, vacuum cleaners, heating pads, ultraviolet lamps, electric blankets, electric shavers, hair dryers, beauty shop equipment, fans, refrigerators, washers, oil-burners, stokers, etc.). Defective or loose light bulbs, lamp sockets, plugs, or wall outlets. (Old-type filamentary light bulbs may interfere with a local TV channel, as may other appliances. A local case involving severe interference on Channel 4 was traced to an electrically-operated steam wallpaper cleaner.)

REASON: Any electrical equipment with a switch, thermostat, brush-type motor, or other rotating or vibrating device produces interfering pulses whose fundamental or harmonic frequencies fall within the bandpass limits of the TV receiver. (The same applies to neon lights and other oscillatory circuits.)

REMEDIES: For outside interference (automobile ignition systems, electrical machinery, etc.), try raising the antenna, reorienting it slightly or, in extreme cases, relocating it on another part of the roof (a directional type must be used here). Run the lead-in as far away from the source of interference as possible and twist it every foot or so. (Shielded cable or coaxial line may be necessary in some cases, but the above procedure should be tried *first*. The twin-lead line is more efficient, has less line losses, and usually can be made to work if the installation or rerouting is carefully done.)

Interference from electrical equipment (appliances, etc.) should be corrected at its source if possible. First, check all lamp bulbs, sockets, appliances, etc., in the customer's home. If this source is clear, ask neighbors, nearby stores, garages, etc., for permission to check electrical equipment, fans, lights, cash registers, adding machines, pressure pumps, neon flashers, etc. (A portable TV receiver or battery-operated AM receiver with a built-in exploring loop is your best ally in locating electrical interference.) When the source is found, ground the metal case of the equipment if possible, and install a low-pass filter in the a.c. power line (as close to the offending motor or moving contacts as possible). A simple filter (.01 to .1 μfd. condensers from each side of line to chassis) will work in most cases. Stubborn, hard-to-cure interference can be caused by defective, worn-out motors or brushes. A filter may not help in these cases, and replacement of the worn unit may be the only remedy.

TYPE: Diathermy Interference.

EFFECT: Jagged horizontal bars which move slowly up and down the screen, sometimes accompanied by a low-pitched hum or tearing noise in the sound (Fig. 8).

A strong signal may cause impairment or complete loss of sync.

SOURCE: Diathermy equipment in hospitals, doctors' offices, etc.

REASON: A radiated signal from diathermy equipment covers a very wide band of frequencies. (Interference, however, is limited mostly to prewar diathermy equipment. Modern equipment is well-shielded and radiated strength is kept within FCC requirements.)

REMEDIES: Interference should be corrected by shielding and installing a low-pass filter on the equipment itself. If the source is located, notify the owner. Reporting the trouble to the FCC should be done only as a last resort.

(*Continued on page* 115)

Fig. 4. Mesh or herringbone pattern which is typical of an oscillator radiation interference condition.

★

Fig. 5. This "chicken-wire" pattern often is characteristic of osc. radiation interference.

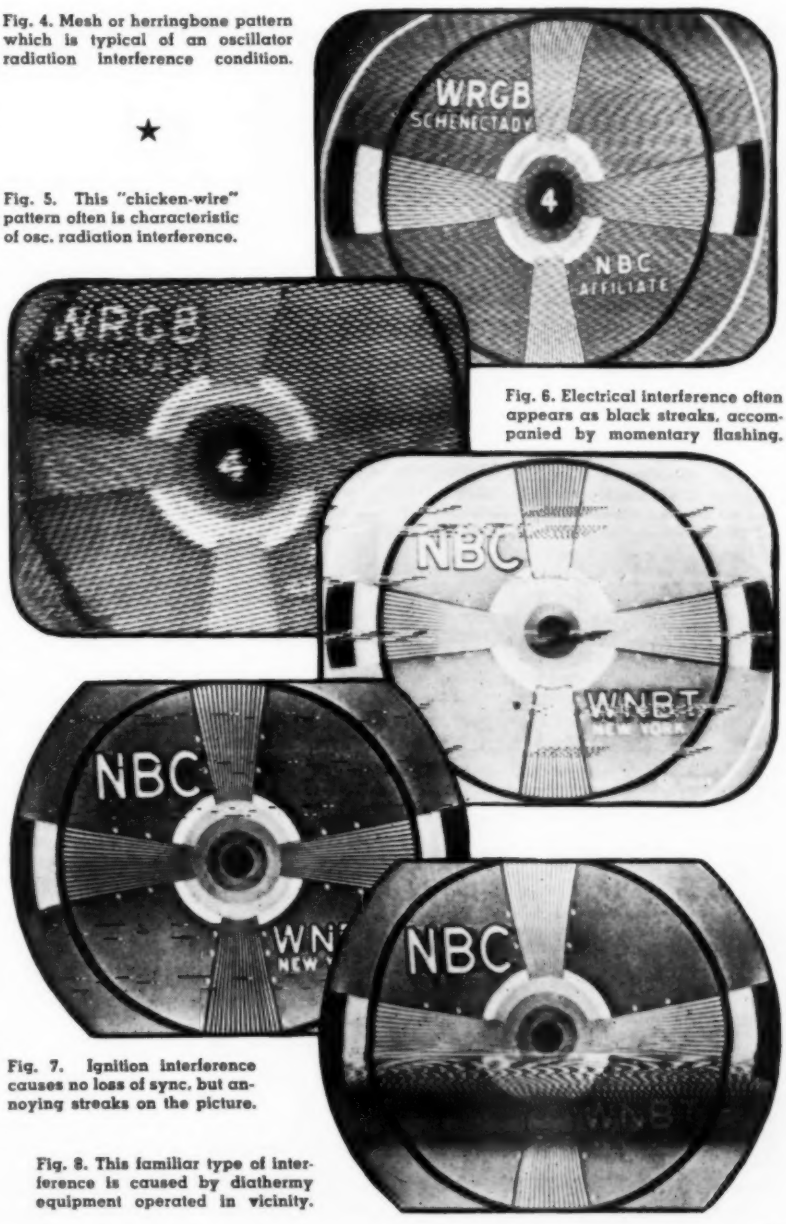


Fig. 6. Electrical interference often appears as black streaks, accompanied by momentary flashing.

Fig. 7. Ignition interference causes no loss of sync, but annoying streaks on the picture.

Fig. 8. This familiar type of interference is caused by diathermy equipment operated in vicinity.

UNIVERSAL DESIGN CURVES for Tone-Control Circuits

By
M. B. KNIGHT
RCA Victor Division
Harrison, N. J.

Part 1. The technician or audio enthusiast can use this practical design data for home-built equipment.

THIS article, the first of a series, is an expanded treatment of the author's discussion on practical *RC* tone-control circuits which originally appeared in the November 1951 issue of this magazine. The present series will describe simple circuit arrangements suitable for particular types of tone control and include frequency-response curves obtained with each circuit. The curves permit rapid evaluation of the ability of a circuit to fulfill specific design requirements. They also indicate the preferred potentiometer taper and facilitate the choice of component values.

The article in the November issue included two simple tone-control circuits; one for fixed or variable treble attenuation or fixed bass boost, and another for fixed or variable treble boost or fixed bass attenuation. This article covers a circuit designed primarily for variable treble attenuation.

Fig. 1 shows a tone-control circuit for fixed or variable treble attenuation or fixed bass boost. It was shown in the November article that a disadvantage of this circuit when used for variable treble tone control is its inability to provide a gradual tone adjustment over the full range of the potentiometer. Fig. 4 shows an equivalent circuit for a variable treble-attenuating tone control which, when properly applied, permits a smooth adjustment even with a linear pot.

This circuit is often used as shown in Fig. 1. In this circuit the resistance R_1 is the effective parallel value of the plate load resistor, R_p, and the plate resistance, r_p, of the tube V_1; the potentiometer R is used as the grid resistor, R_g, and is much larger than R_1. As a result, this circuit behaves much like the circuit shown in Fig. 2 and has the same disadvantages. To obtain gradual tone adjustment, it is desirable to make R small compared to R_1. Because a reduction in the value of the grid resistor would result in an objectionable loss in gain, the logical solution is to use the potentiometer as the plate load resistor, as shown in Fig. 5. With this arrangement R_1 is equal to

$$\frac{1}{\frac{1}{r_p}+\frac{1}{R_g}}$$

and will usually vary between the limits of one-fifth R (if V_1 is a triode) and five times R (if V_1 is a pentode). The frequency-response curves for this circuit, shown in Figs. 3, 6, 7, 9 and 10, indicate that a potentiometer with a logarithmic taper is desirable if V_1 is a triode, but if V_1 is a pentode a linear pot is usually preferable.

When the circuits shown in Figs. 1, 2, and 5 are used in high-level stages, care must be taken to avoid excessive distortion. Where high frequencies are being attenuated appreciably, the a.c. load impedance presented to tube V_1 is quite low and, as a result, the maximum permissible grid swing is reduced. It is not advisable, therefore, to attempt to obtain the maximum output voltage indicated in the "Resistance-Coupled Amplifier Charts" found in tube handbooks. Particular care must be taken not to attempt to obtain too much output voltage when the circuits are used for fixed bass boosting. When the circuits are used for treble attenuation, the distortion may not be objec-

Fig. 1. Application of the circuit of Fig. 4 with R much larger in value than R_1.

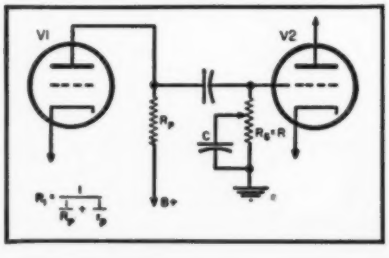
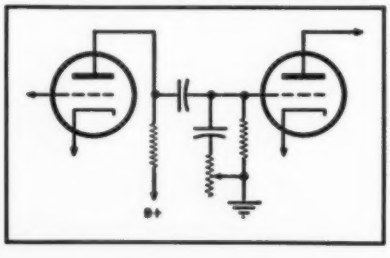


Fig. 2. Circuit providing fixed or variable treble attenuation and fixed bass boost.



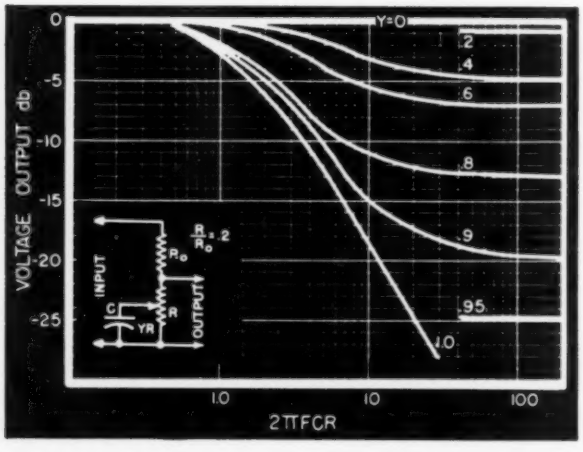


Fig. 3. Universal design curves for circuit of Fig. 5 when R/R_o is equal to .2.

Fig. 4. Equivalent circuit for a variable treble attenuating type of tone control.

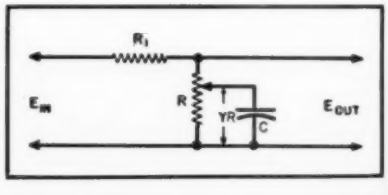
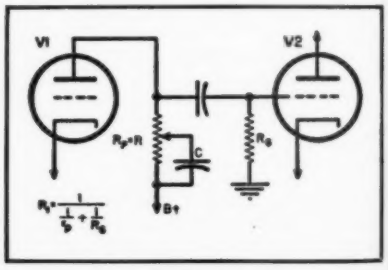


Fig. 5. Preferred application of the circuit of Fig. 4 with the potentiometer used as plate load resistor.



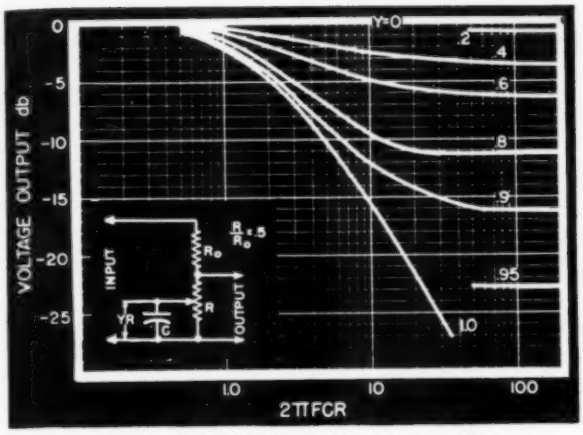


Fig. 6. Design curves for circuit of Fig. 5 when R/R$_o$ = .5.

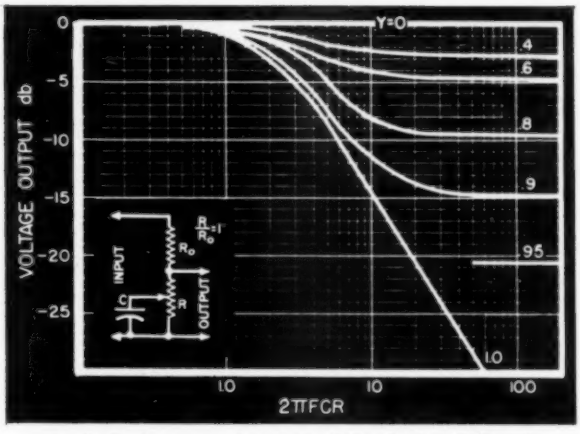


Fig. 7. Design curves for circuit of Fig. 5 when R/R$_o$ = 1.

tionable because of the coincident attenuation.

Distortion may be minimized by methods other than simply using the circuits in relatively low-level stages. The experienced designer can adjust the grid bias on tube V_1 to compromise between the relatively high a.c. load impedance at low frequencies and the lower load impedance at high frequencies. This compromise can usually be achieved by a slight decrease in bias. Another method, which reduces the gain, however, is the addition of resistance in series with the plate of V_1. This latter method may be particularly useful with the circuit of Fig. 5 if V_1 is a triode because it may permit smooth tone control with a linear potentiometer.

To illustrate the use of the design curves, let us design tone controls for both a triode and a pentode, using the circuit given in Fig. 5. In each instance we shall assume that we want the maximum treble attenuation (y = 1) so that attenuation of 3 db is obtained at 1500 cycles. (The letter y denotes the setting of the tone control and is defined to mean the fraction of the total resistance of R included across condenser C.)

For a triode tone-control circuit, suppose we are using a 6SN7GT in accordance with operating conditions given in the Resistance-Coupled Amplifier Charts. The plate load resistor, R_p, is 50,000 ohms, the grid resistor, R_g, of the following stage is 250,000 ohms, and the plate supply voltage is 300 volts. The cathode resistor, R_k, is 1500 ohms and the value of mu, obtained from the tube data, is 20. In order to determine the value of R_1, we first calculate the value of R_o, the effective parallel value of the grid resistor, R_g, the plate load resistor, R_p, and the plate resistance, r_p, of tube V_1. As was mentioned in the preceding article, we have found a formula which may be used to calculate R_o directly with fair accuracy. (It must be remembered

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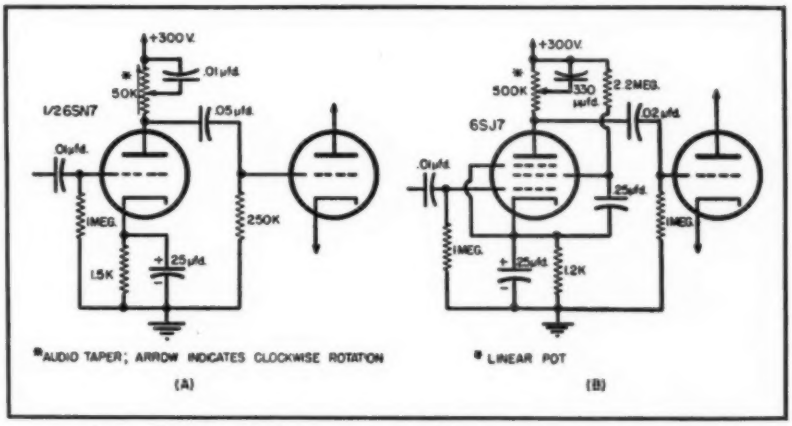


Fig. 8. (A) Typical triode tone control capable of providing 3 db of attenuation at 1500 cps. (B) Pentode tone control for 3 db attenuation at 1500 cps.

Fig. 9. Design curves for circuit of Fig. 5 when R/R$_o$ = 2.

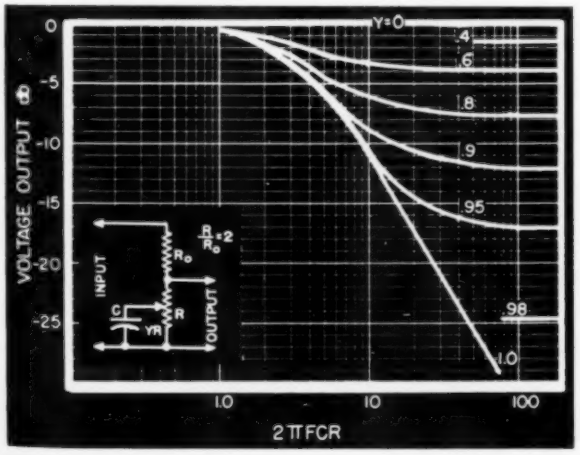
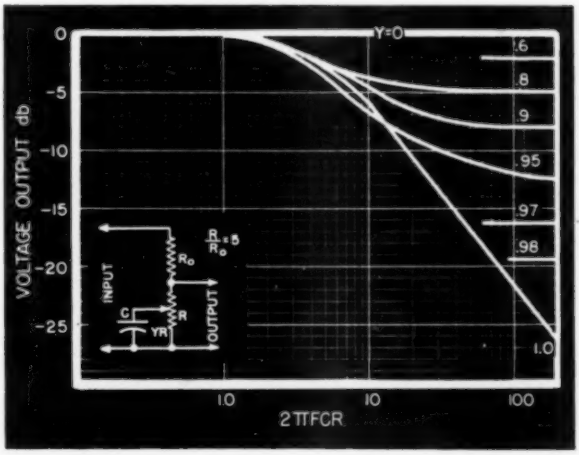


Fig. 10. Design curves for circuit of Fig. 5 when R/R$_o$ = 5.



HAMS AGAIN at DISASTER SCENE

By **HAL SAGERT, W9BEF**
Comm. Engr., Chicago, Rock Island & Pacific R. R.

A patrolman, equipped with a two-way radio, reports on the condition of the dikes which were thrown up around the North Omaha pumping station during flood.

Amateurs win new laurels for their tireless battle against the Midwestern floodwaters.

TWO-WAY communications equipment, in many instances manned by hams, played a decisive role in the epic struggle between the Missouri floodwaters and persons whose homes lined its banks.

While the hams who spent countless hours at the mobile and fixed transmitters expect no official recognition of their sacrifices, they do deserve a resounding "Well done!".

In Omaha and Council Bluffs, hams, industry representatives, as well as local and federal agencies worked together as a team to coordinate defense and rescue efforts. For ten days and nights hams operating on the Union Pacific Railroad frequency of 160.29 mc. manned stations set up in the Omaha City Hall and the Union Pacific headquarters building. From these stations were dispatched the emergency crews which were then rushed to the scene of possible breakthroughs. Vital information on the condition of the dikes was relayed periodically by patrolmen who walked the levees and reported their observations by means of portable two-way radio units. —30—

Mobile station receiving orders from the net control with Harry Snyder of Fremont, Neb., as operator.

Amateur radio control station with Roy McCabe, WØUVU of Fremont at the controls and Mrs. I. Conklin, WØNXW, of Manilla, Iowa, about to take the "graveyard" shift.

One of the dike patrolmen making his half-hourly report to the flood control headquarters over his Motorola "Walkie-Talkie." These men maintained 24-hour watch on the dikes to report leaks, signs of weakness, and incipient collapses.

Radio maintainer straps handset to shoulder strap where handset receiver permits continuous monitoring of 160.29 mc. channel. Note that the dike patrolman wears a life jacket in addition to his compact transmitter-receiver carrying case.

PUBLIC ADDRESS SYSTEMS AID BARKERS

By
JAMES KAUKE

Earn extra income by renting or selling compact p.a. systems for hall, church, or carnival use.

THE day of the leather-lunged barker is rapidly drawing to a close with the widespread adoption of small public address systems by carnivals, bingo games, sideshows, and other similar attractions.

Formerly the barker or operator depended a great deal on the volume of his voice. With the use of a small public address system, voice volume is no longer important, and any desired crowd or gathering may be covered with little effort on the part of the operator.

With the high noise level of the average sideshow or carnival, only those in the immediate vicinity of the barker could hear the "pitch," with the result that the maximum crowd was not attracted. With a public address system, almost any size crowd may be covered with the same effort.

For carnival or sideshow use, the maximum usable volume is determined by the proximity of the neighboring attractions, and the noise level. To avoid conflict with the other shows, either a staggered operating schedule must be used, or the volume held down to the minimum necessary for coverage. For the majority of applications of this nature, relatively low output power is adequate, and amplifiers in this service usually develop between three and twenty watts of power, with the average unit having an output of about ten watts.

The personnel using equipment of this type are non-technical, and consequently the equipment must be simple to operate and have a minimum of controls. As the equipment may be subject to rough handling it must be designed to operate satisfactorily under almost any conceivable condition.

In most outdoor installations it is necessary to dismantle the equipment at the close of business each day, and this requires that the installation be as simple and lightweight as possible. Bulky equipment or complicated installation will defeat the "simple" appeal, and tend to build sales resistance on the part of the customer.

It is a common practice to use music to fill in the intervals between shows and act as an added attraction. This music can be easily supplied by a small phonograph connected to the phono input of the amplifier if the amplifier has provision for such input.

The amplifier shown on this month's cover fulfills these requirements adequately. It is a ten watt model E-10 manufactured by the *Newcomb Audio Products Company*, and is furnished with both microphone and phono input. A carrying case with a self-contained speaker is also available for portable applications. A tone control circuit allows the operator to adjust the tone for the best coverage.

Multiple output connections are available to allow the use of speakers of various impedances, or different combinations of speakers.

In the matter of microphones for use in such installations, the user has a wide selection of types from which to choose.

A hand-held unit has many advantages in this type of work as its use is not limited to a single person but can be passed around as required.

The microphone shown on this month's cover, the *American Microphone Company's* D4G, is another such possibility. It is a "chest" type which uses a leather-covered spring steel strap to hold the microphone in correct relation to the user's mouth.

Desk and floor-stand models, while allowing less freedom of movement for carnival barkers, etc., are excellent for banquet speakers, pulpit installations, and such. Lapel mikes offer still another possibility, especially for indoor and relatively quiet installations, but may be less effective in outdoor locations because of the background noise picked up.

A great many different types of speakers may be used, depending on the particular application. For indoor installations, any of the several conventional speakers mounted in baffles or carrying cases may be used with the housing selected on the basis of a temporary or permanent installation.

In outdoor installations, the speaker requirements are more exacting, especially if the installation is of a permanent nature. The speaker should be selected for its weatherproof quality and field of coverage.

Various types of speakers are available for outdoor installations. The most popular are the trumpet, radial reflex, and the wide-angle type shown in the cover photo. The exact type selected will vary with the area to be covered, and should be chosen on this basis. The unit pictured is an *Altec-Lansing* speaker which is especially suited for wide angle coverage. In other applications it is probable that another type would be better suited.

The convenience of small p.a. systems in applications of the type illustrated has done much to increase the appeal of carnivals and other types of sideshows, and offers an additional source of revenue for the service technician and dealer in equipment of this type. —30—

Improved Intercarrier Sound System

By
WALTER H. BUCHSBAUM
Author, "Television Servicing"

Circuit details and alignment data on a sound system being used in many of the 1952 model television receivers.

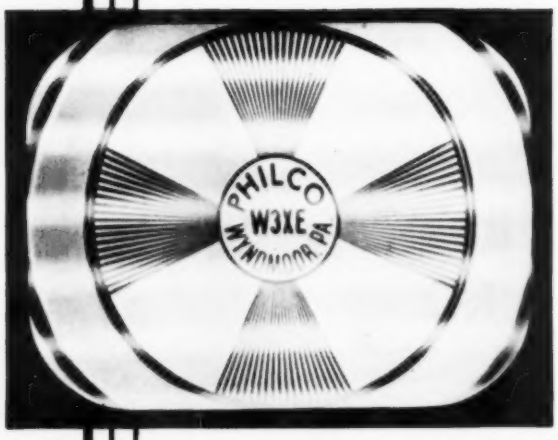
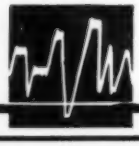


Fig. 1. A type of interference due to slope detection. This circuit fault was fairly common in the early intercarrier video sets.



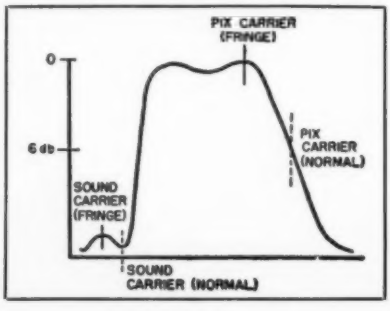
IN PRESENT television broadcasting the picture signal is transmitted on an amplitude modulated carrier while the sound signal is sent along on a frequency modulated carrier, 4.5 mc. *higher* than the picture carrier. At the receiver the local oscillator beats with both picture and sound carrier and produces an i.f. signal in which the sound carrier is 4.5 mc. *lower* than the picture carrier. Most old type television receivers separate the sound and picture carriers in the i.f. section and amplify and detect them in different sections of the receiver. In the intercarrier system both sound and picture carrier are amplified together through all i.f. stages. At the second detector the sound and picture carrier produce a beat signal of 4.5 mc. and this beat signal carries the frequency modulated sound as well as some of the amplitude modulated picture signal. Although no second local oscillator is used here it is correct to consider this a double superheterodyne system because effectively two i.f. frequencies are used. The 4.5 mc. i.f. signal is then amplified and the FM sound signal which it carries is detected in either a ratio detector or discriminator circuit.

The obvious advantage of the intercarrier system is the fact that the 4.5 mc. i.f. which is fed to the FM detector remains at exactly that frequency regardless of local oscillator drift or misadjustment of the fine tuning control. As a matter of fact in many intercarrier receivers the fine tuning control is omitted. Another great advantage of the intercarrier system is that it is possible to detune the receiver for extremely weak signal areas and still get clear and undistorted sound. Just how this helps out in a fringe location is shown in Fig. 2. The dotted lines represent the normal location of the picture and sound carrier on the i.f. response curve. Shown in solid lines is the arrangement obtained by detuning slightly and sliding the picture carrier up on the i.f. response. A picture signal increase of 2:1 can be achieved here and although this results in some loss of fine detail, this loss is often tolerated to get more contrast. If such detuning were attempted in a "split-sound" receiver the sound i.f. would be incorrect and the FM detector would produce only a garbled and distorted noise.

Early Intercarrier Sets

As most TV technicians have observed, older intercarrier receivers are subject to a number of annoying de-

Fig. 2. Normal location of the picture and sound carrier on i.f. response curve (dotted lines) and arrangement obtained by detuning slightly and sliding the picture carrier up on i.f. response (solid lines).



fects. Probably the most notorious is buzzing. The symptoms are quite easy to recognize and often very difficult to cure. The sound system produces an audible buzz or hum which is especially bad on strong stations. Sometimes this buzz can be reduced by careful alignment of the ratio detector and all 4.5 mc. circuits, sometimes nothing seems to help. When viewed on the oscilloscope this buzz turns out to be the regular 60-cycle vertical synchronizing pulses which are being amplified along with the FM sound signal. As mentioned before, the 4.5 mc. beat signal contains both the FM sound carrier and the picture carrier of which the 60-cycle pulses are the most pronounced feature. Another drawback of some earlier intercarrier systems was the appearance of a fine, grid-like interference pattern on the screen. This was the 4.5 mc. signal becoming visible due to an overly broad video amplifier response curve. The other extreme, a narrow video response curve, resulted in loss of fine picture detail and a dull and fuzzy appearance. One other disadvantage of the earlier intercarrier circuits was the operation of the ratio detector under strong ignition noise. Because of the fairly large electrolytic condenser, often 10 μfd., strong noise pulses appeared to "punch holes" in the sound by silencing the detector circuit for audibly long periods. The "split-sound" receivers used a discriminator circuit which suppressed noise pulses but did not exhibit any long silent periods.

One more drawback of the earlier intercarrier sets was the limited bandwidth used both in the i.f. and video amplifier sections. In the i.f. this was done to avoid slope detection of the sound signal. If the video detector, by slope detection principles, removes the FM sound modulation this sound signal is amplified by the video amplifier and looks like the 400-cycle bar interference shown in the photograph of Fig. 1. In older receivers the i.f.

bandpass is so arranged that the sound i.f. is at the flat bottom portion of the i.f. curve. To reduce 4.5 mc. interference in the picture, the video frequency response of some low cost receivers appeared like the curve in Fig. 3A. The curve in Fig. 3B is closer to the ideal and will give much snappier pictures and finer detail.

Because of these shortcomings intercarrier circuits were used mainly in inexpensive receivers where the fact that one or two tubes could be eliminated outweighed the poor performance of the set. Recent developments, however, have shown that an intercarrier system can be designed which exhibits all of the advantages and none of the shortcomings of the earlier models. There are no substantial savings in parts or labor in this improved system, but its superior performance has caused it to be adopted by practically all nationally-known TV manufacturers. The improvements made in the original system are not all as obvious as adding another 4.5 mc. i.f. amplifier tube. Some of these new features can be incorporated in older sets and eliminate some chronic complaints, others may require excessive modification. Understanding the principles involved and their application in circuits will help the technician with older sets as well as with the 1952 models now using these circuits.

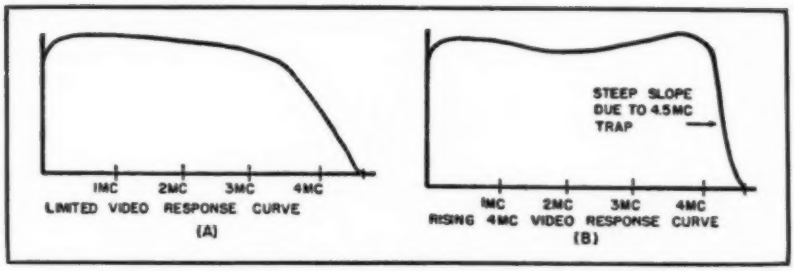


Fig. 3. (A) Limited video response curve, and (B) rising 4 mc. video response curve.

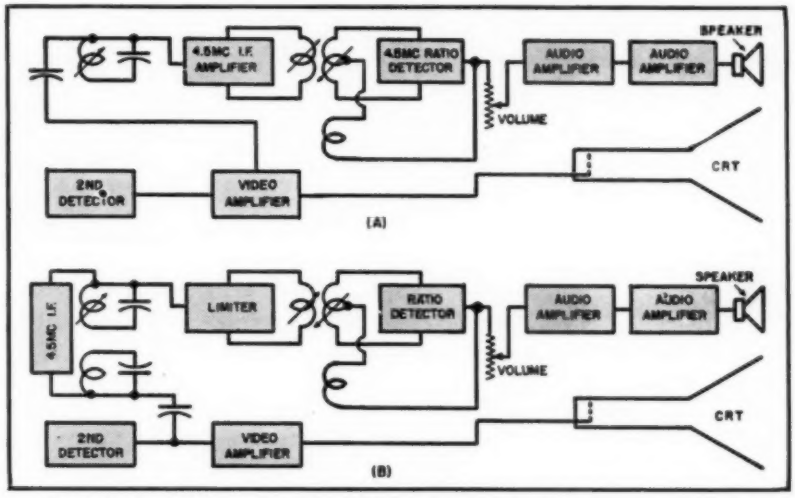


Fig. 4. (A) Block diagram of early-type intercarrier circuit. (B) New version (see text).

Intercarrier Improvements

The most outstanding and most beneficial change is the addition of a second 4.5 mc. i.f. stage and the removal of the 4.5 mc. i.f. directly at the second detector. The additional i.f. amplifier provides much greater selectivity to the 4.5 mc. signal and more effective rejection of lower frequency video signals. Instead of the two tuned circuits shown in the block diagram of Fig. 4A, the three resonant circuits in Fig. 4B, the new version, give improved sound sensitivity as well as less interference. In the first system the ratio detector is driven by a single tube which usually was designed to provide some limiting on very strong noise pulses. When weaker signals reached its grid, no limiting occurred. Thus the entire burden of rejecting amplitude modulation fell on the ratio detector circuit. This circuit, however, rejects AM signals best on medium strength signals. When either very weak or very strong signals are used, AM rejection is not too good. Note that in the improved intercarrier version the tube immediately preceding the ratio detector works as a true limiter, which is possible because it receives sufficient signal to build up a high grid bias. Low screen voltage, together with high grid-leak bias, clip and limit much of the AM portion of the 4.5 mc. i.f. This permits the ratio detector to do a much better job of removing the remaining AM components, especially since the signal coming from the limiter is almost constant in amplitude, regardless of the received signal strength. The gain in the first 4.5 mc. i.f. amplifier need only be from 20 to 30 times to give enough signal for the limiter and ratio detector. Pentode i.f. amplifiers like the 6AU6 which is most often used in this circuit, usually provide at least a gain of 30 times.

Since the 4.5 mc. signal is taken off at the detector, much less of it is amplified in the video amplifier section. But to make absolutely sure no 4.5 mc. interference can occur, a series or parallel trap is often used in the video amplifier. With the use of such a trap it is possible to extend the video amplifier response curve to about 4 mc. and yet provide a sharp dip at 4.5 mc. Such a curve is shown in Fig. 3B, and will invariably add greatly to the snap and resolution of the picture. On large screen tubes the difference in video response curve is quite pronounced.

The circuit of Fig. 5 is typical of the improved versions of the intercarrier system. The ratio detector section is the balanced type and differs from older circuits mainly in the use of a 2 μfd. condenser for C_{16}. The smaller value helps reduce "holes" due to ignition noise. The 6AU6 limiter tube operates at low screen voltage, usually about 60 volts, and grid leak bias is developed across R_4, the 120,000 ohm grid resistor. In the circuit shown

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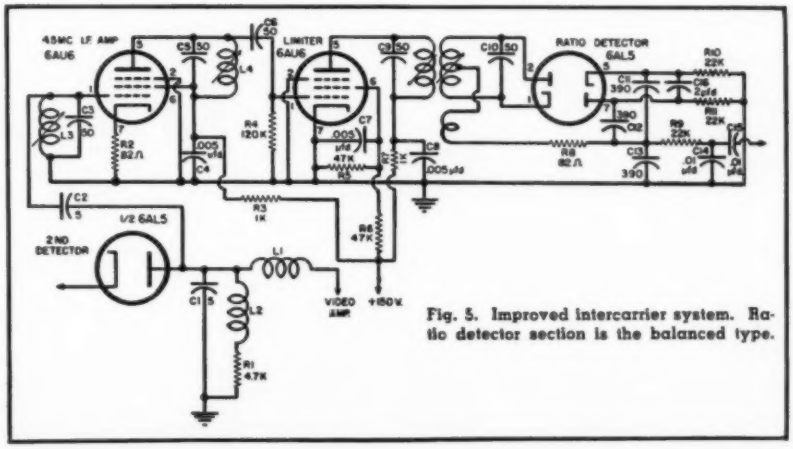


Fig. 5. Improved intercarrier system. Ratio detector section is the balanced type.

Unique Magnetic-Tape Applications

Donna Atwood, star of Ice Capades of 1952, gives her reaction to the Ice Capades' unique use of pre-recorded tape. The Ampex Model 200 has traveled more than 30,000 miles and recorded and played back an average of 360 shows a year. The equipment is still in use.

By LEON A. WORTMAN
Director of Adv. and Sales Promotion
Audio & Video Products Corporation

A diversified group of organizations have adopted magnetic tape to solve special sound problems.

AS "REEL REVIEW," a monthly feature in this magazine, gains recognition, more interesting information and unique applications of magnetic tape are brought to our attention. One of the most unusual, and rather interesting, applications we have encountered is the way in which the "Ice Capades" show uses *pre-recorded* magnetic tapes.

The "Ice Capades" is an itinerant unit, traveling around and across the entire nation several times a year. It is continually faced with the problems of setting-up and tearing-down. The cast of "Ice Capades" is quite large, enabling the presentation of extravaganzas on ice. Such presentations as "Snow White," "Student Prince," and "Cinderella" are staged with music, singing, dialogue, and special dance routines. The problems of feeding a public address system are obviously extremely difficult and quite unusual. The technical directors of the "Ice Capades" found the solution to this particular problem in pre-recorded magnetic tape.

The cast of actors and singers prerecord all singing and dialogue on magnetic tape. Continuous rehearsals and applications of the art of editing, so practical with magnetic tape, provide the show with the best possible audible elements of the productions. During the actual performance, the magnetic tape is fed into a mixing console. Microphone pickups are placed in front of the huge orchestra which travels with the "Ice Capades." The orchestra, following the conductor's baton, then plays in synchronism with the tape recorded vocals. The performers on the ice "mouth" the prerecorded vocals and dialogue as they go through the skating routines. Everything is amplified and piped through horns suspended above the rink. Therefore, during the performance the audience sees skaters, actors, and a live orchestra all going through the motions of a live performance while a good portion of the sound is actually coming from the magnetic tape. John A. Harris, president of the "Ice Capades," writes that the illusion is perfect, enhanced by the fact that no microphones can be seen on or above the ice. Microphones would represent a real hazard to skaters and their use would, therefore, be undesirable.

Several questions regarding magnetic tape were submitted to Mr. Harris: Do you have confidence in the durability of magnetic tape and the recording equipment? How much usage have you given your present equipment? How often do you service the equipment? Mr. Harris replied that his machine has worked three full seasons and traveled more than 30,000 miles, doing an average of 360 shows a year. He states they are quite satisfied with the job that magnetic equipment has done and that it has certainly stood up well. Once each year the machine is checked over completely and the only important replacements have been those that would have been necessary anywhere, such as brake bands and mechanical parts that just wear out from use.

Donna Atwood, star of the "Ice Capades," added, "I had great concern in our first year of the presentation of the dialogue because we were using discs. Regardless of how many discs they used, there was always the surface sound present and in so many cases scratches would develop but, most of all, the fact that the slightest

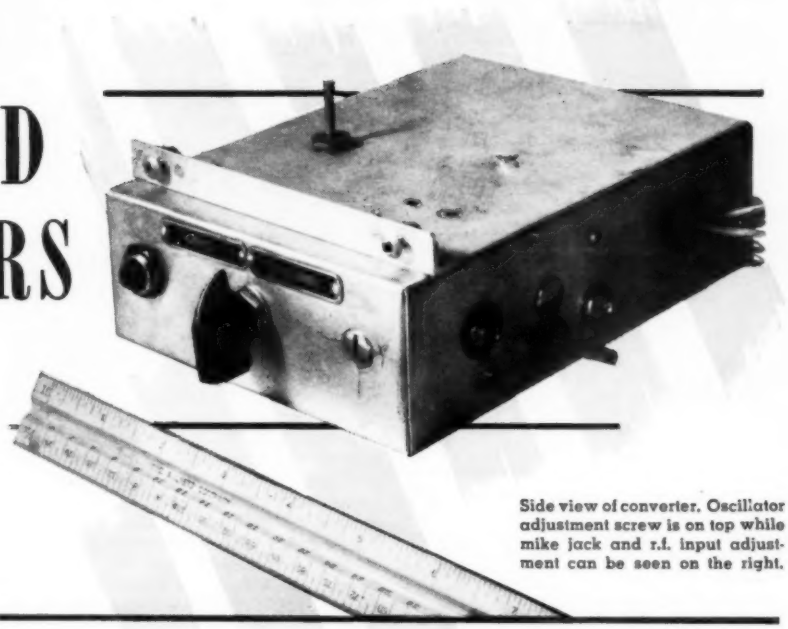
(*Continued on page* 112)

Robert J. Coar, coordinator of the Joint Senate and House Recording Facility in Washington, is shown with Senator Joseph C. O'Mahoney of Wyoming in the tape recording room. The Facility is made available to members of the House and Senate for recording progress reports for the benefit of their constituents.

IMPROVED BROADBAND CONVERTERS

By

ALVIN B. KAUFMAN,
W6YOV



Side view of converter. Oscillator adjustment screw is on top while mike jack and r.f. input adjustment can be seen on the right.

This new version of the unit originally described in the March 1950 issue features lowered background noise, better signal-to-noise ratio, and an improved over-all gain.

THE author's article on broadband converters which appeared in the March 1950 issue of RADIO & TELEVISION NEWS was received with so much enthusiasm by the SWL and amateur, that the author felt that new design improvements should be passed along to the reader. The modifications for improvement require no major overhaul for those who built the two-tube converter and, for the newcomer, complete construction details are supplied on a converter that may be built with limited finances and without any of the bugs or complications encountered in many such units.

The reader will be pleased by the simplicity and straightforward design of this converter, which may be used on the 75, 40, 20, or 10 meter amateur bands as well as on aircraft, police, or civil defense frequencies.

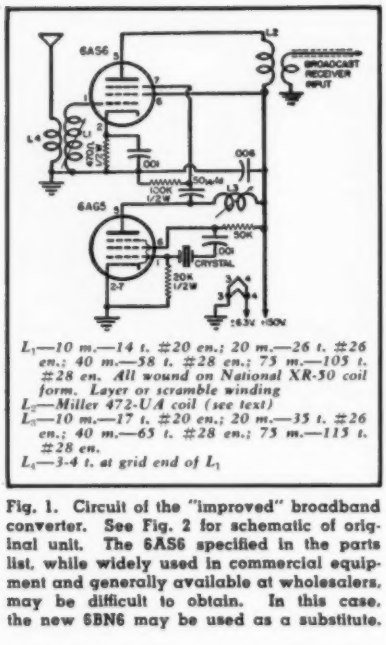
In general, there are two types of converters presently in use. By far the most common is the tunable converter wherein the receiver is tuned to a fixed point and the converter oscillator frequency is varied so as to produce a conversion or mixed frequency, always at the same frequency to which the receiver is tuned. The other type of converter, not commonly in use, employs a wide-band r.f. input and output and a fixed-frequency oscillator. This is the "broadband converter." Its output frequency varies with the frequency of the incoming signal and must be detected by tuning the receiver rather than the converter. The converter to be described is of the "broadband" variety with another important innovation added, *i.e.*, crystal control.

One common complaint about practically all high-frequency converters is frequency drift and, for the builder without a signal generator, difficulty in securing proper operation. Crystal control eliminates both of these troubles. There are no tricky adjustments and no difficulties encountered in tuning or finding the frequency range covered by this converter. With the proper crystal frequency your car or house radio tunes the ham band as a perfect "bandspread" unit. Transmitting or receiving type crystals are used in the converter; the crystal frequencies to use for the different bands will be indicated during a discussion of the converter. The crystals used are not expensive as an accurate frequency is not required. No special frequency unit is required for the ten-meter band.

A two-tube converter of this type admittedly does not have the gain of a four- or five-tube unit, but neither is it as expensive. In its field of operation its good points certainly outweigh any objections to its lessened sensitivity or slight loss of bandwidth when used on the ten-meter band. On the ten-meter band the author has received signals from all over the country and considers the sensitivity satisfactory.

There is one prerequisite that *must* be met when a broadband converter is used. The broadcast receiver tunes in the converted signal as if it were on the broadcast band. This means that the BC receiver must be completely "dead" at nearly full volume when the antenna is not connected. Car radios, being well shielded, generally have no pickup, but the average inexpensive a.c.-d.c. set may have excessive pickup in which case it would interfere with the short-wave signal. In any case a shielded cable must be used from the converter into the broadcast receiver. This cable should be of the low-loss coaxial type such as RG 29/U, RG 58A/U, or RG 62/U, etc. With the converter connected to the receiver a small amount of broadcast signal may come through until the converter warms up and supplies a signal and background noise to operate the a.v.c. in the receiver.

The converter employs two tubes, one as a crystal-controlled oscillator and one as mixer. Starting at the antenna the r.f. signal may be tapped into the r.f. coil a few turns from the bottom or fed in through the coupling antenna coil as shown in the schematic. This coil is of the high-"*Q*" type. A *National* XR-50 coil form is wound with sufficient wire so that with its variable iron core and the tube's input capacity it will tune through any band selected. The coil windings for 75 meters and the lower frequency may be either layer or scramble wound without apparently affecting the broadband converter performance. For the higher frequencies it is desirable to space the winding the length of the XR-50 coil form but by experience it has been found that when this coil form is used the winding is not critical, making only a few hundred kc. difference in the tuning range allowed by the slug adjustment. The additional capacity introduced into the r.f. grid coil circuit by the coupling coil and shielded lead, etc. may, in some cases, necessitate the removal of several turns on the higher frequency coil in order to obtain the best tuning range. In all cases the best "*Q*" is secured when the tuning slug is as far out of the coil as possible. If necessary, the grid coil should have its



L_1—10 m.—14 t. #20 en.; 20 m.—26 t. #26 en.; 40 m.—58 t. #28 en.; 75 m.—105 t. #28 en. All wound on National XR-50 coil form. Layer or scramble winding
L_2—Miller 472-UA coil (see text)
L_3—10 m.—17 t. #20 en.; 20 m.—35 t. #26 en.; 40 m.—63 t. #28 en.; 75 m.—115 t. #28 en.
L_4—3-4 t. at grid end of L_1

Fig. 1. Circuit of the "improved" broadband converter. See Fig. 2 for schematic of original unit. The 6AS6 specified in the parts list, while widely used in commercial equipment and generally available at wholesalers, may be difficult to obtain. In this case, the new 6BN6 may be used as a substitute.

winding reduced from the turns given in the coil table accompanying Fig. 1.

The coil shows high *"Q"* over a wide frequency range, falling off rapidly from the selected frequency out some distance. Rather than lower the *"Q"* by loading the coil with a resistor, which would "broaden the response" to the detriment of the center frequency gain, no loading devices were used. In television where a flat response over a wide frequency range is required, loading is employed even though loading effectively lowers the resonant frequency gain of the coil. Summed up in simpler words, the unit will be "hottest" near the peaked frequency of the coil. This coil's iron core should be adjusted after it is connected to the antenna so that it will resonate close to the frequency at which your transmissions are taking place or at that section of the band where peak performance is desired. In actual practice the performance over the entire band is quite satisfactory.

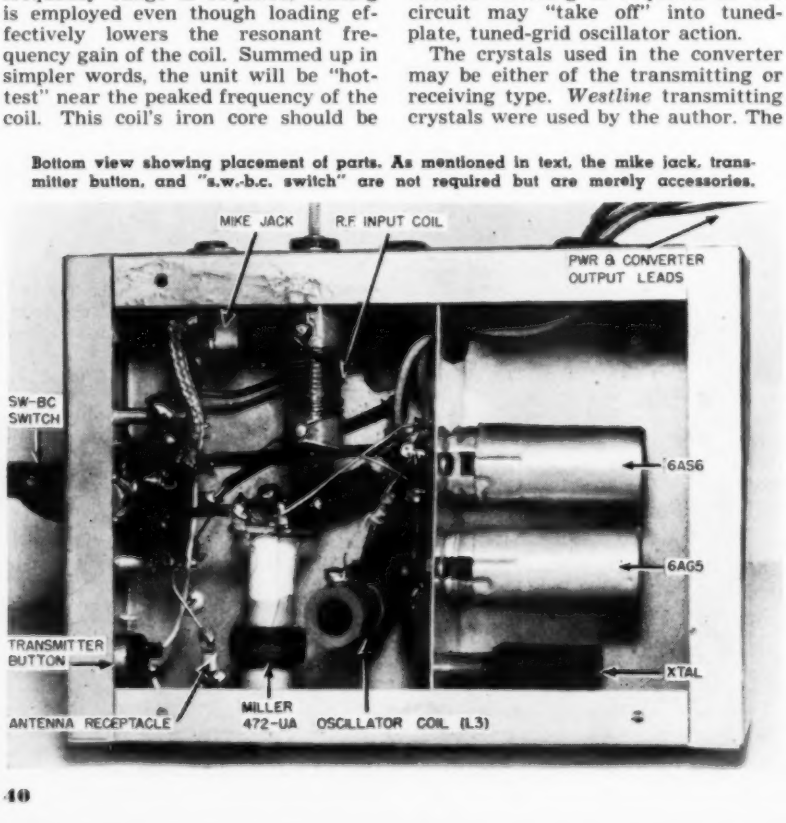
The plate of the 6AS6 is connected to a *Miller* 472-UA r.f. coil. The *Miller* 472-UA coil is a broadband broadcast coil designed to couple an antenna to the grid of the first r.f. tube, which is untuned. Here it is used in reverse. The grid winding is used as the plate winding in the converter, while the antenna coil feeds the converter output into the broadcast receiver antenna input. See Fig. 3. This coil must be modified slightly from the manufacturer's configuration to fit this circuit. The grid return and bottom of the antenna coil are connected and are common on one post. These must be unsoldered and one wire shifted to the unused lug on the Micarta strip. The aluminum shield can which houses this coil may be dispensed with, as was done on the author's unit, to provide a more compact converter.

The special 472-UA coil is available at most wholesale radio stores, but may also be secured from the *J. W. Miller Company*, 5917 South Main Street, Los Angeles 3, California.

The use of a broadband broadcast frequency coil in the plate circuit of the converter makes special shielding unnecessary. Where both the plate and grid circuits are tuned to the same frequency (as in some converters) careful shielding is required or the circuit may "take off" into tuned-plate, tuned-grid oscillator action.

The crystals used in the converter may be either of the transmitting or receiving type. *Westline* transmitting crystals were used by the author. The crystal frequency selected should preferably be at the low frequency end of the band. This is done so that as the incoming short-wave signals increase in frequency the resultant conversion frequency is also higher and thus the receiver is tuned to a higher frequency. On certain bands this permits adding a factor to the broadcast receiver dial setting and reading it directly in the short-wave frequency! The crystals should be of the following frequencies. A 3000 kc. crystal should be used for the 75-meter band. Here the low frequency end of the band, 3500 kc., will appear at 500 kc. on the broadcast receiver while 4000 kc., the high frequency end of the band, will appear at 1000 kc. on the dial, etc. Thus for the 75-meter band a factor of 3000 would be added to the dial indication. Any crystal frequency close to 3000 kc. would be satisfactory and such crystals may be found in surplus or may be ground on special order for a few extra dollars. A 2500 kc. crystal could be used, in which case the 75-meter band would fall between 1000 and 1500 kc. on the receiver. The crystal frequency selected depends, to a large degree, on how accurately you wish the broadcast dial to reflect the short-wave frequency. For the 40-meter band a crystal frequency of 5800 to 6500 kc. can be used. A 6000 kc. unit is preferable as the low frequency end of the band would appear at 1000 kc. on the receiver and the broadcast dial could be read directly in short-wave frequency by adding a factor of 6000. The 20-meter band could be covered by a crystal frequency of 6450 to 6750. Again 13,000 kc. would be best, the low frequency end of the band appearing at 1000 kc. on the receiver. A factor of 13,000 would be added to make this band track on the receiver. In this case a 6500 kc. crystal would be used, and its second harmonic of 13,000 kc. injected into the mixer tube. These lower frequency bands present no problem of frequency coverage as they are only 300-500 kc. wide and thus the radio receiver gives more than adequate coverage and sufficient bandspread. The 10-meter band, being 1700 kc. wide, cannot be entirely covered by a broadcast receiver, but the bandspread action is excellent as the band covers more of the dial. Actually for a given increment of dial movement the receiver would tune the same frequency difference on any bands and there would be no difference in selectivity on any of these bands. The proper crystal frequency for 10-meter coverage depends upon which section of the band you wish to receive. My choice is from 28.5 megacycles to 29.6 megacycles. This calls for a 7000 kc. crystal. Its fourth harmonic falls at 28 megacycles and thus by adding 28 to the receiver dial a 28.5 mc. signal appearing at 500 on the dial would be read 28,500. The factor would be 28 or 28,000. An advantage here is that 7000 to 7010 kc. crystals are easily obtainable as they are in the 40-meter

Bottom view showing placement of parts. As mentioned in text, the mike jack, transmitter button, and "s.w.-b.c. switch" are not required but are merely accessories.



band. To cover from 29,700 kc. down, a 7050 kc. crystal is necessary.

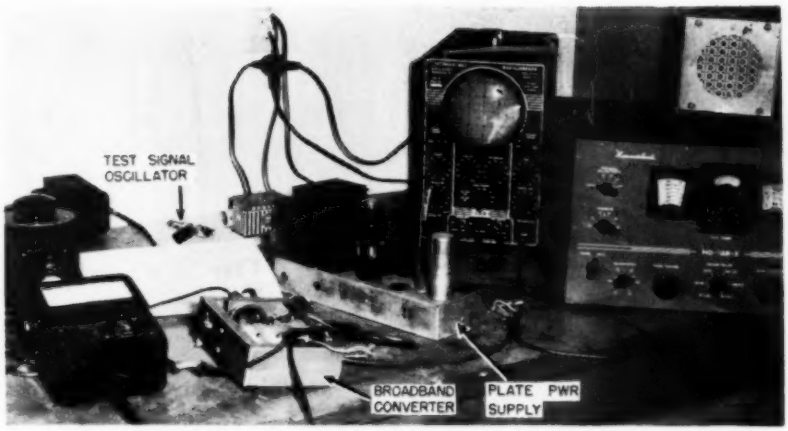
A 10-meter version of the converter was constructed and installed in the author's car to complete a mobile station. Although the previous information regarding crystals, coils, etc. applies to this unit, as well as the old dual 6AG5 converter (Fig. 2), there are additional new features requiring explanation of adjustment or theory. During experimental development of this converter it was determined that the popular 6AK5 tube was not satisfactory as a converter oscillator for two reasons. This tube is rated at 180 volts maximum plate supply and the tubes tested were gassy enough to ionize at the admittedly high supply voltage of 250 volts d.c. The worst feature was the wide change in transconductance when the tube was subjected to vibration. The 6AG5 possesses neither of these objectionable features. Of course, this does not condemn 6AK5 tubes for other uses.

The oscillator section of the converter consists of a single 6AG5 tube whose screen grid circuit is wired as a Pierce oscillator and whose plate circuit is resonated to the fundamental or harmonic frequency required. A low frequency crystal is used for the high frequency bands, as outlined previously, and the plate circuit of the oscillator is tuned to a multiple of the crystal frequency. Both the oscillator coil and the r.f. input coil are tuned while operating the converter into a receiver.

The receiver must have either an "S" meter, no a.v.c., or a very weak input signal applied to it. If a signal generator is not available any signal may be tuned in by the receiver on the ham band. Even without alignment there will be enough signals coming through for this purpose. After a signal or carrier is tuned in, the r.f. oscillator coils are tuned by their iron cores for maximum receiver output. It is advisable to disable the a.v.c. circuit in the receiver if the receiver does not have an "S" meter or peak tuning may be almost impossible. Where a high gain ham receiver is used for this tuning operation, a certain amount of broadcast leakage may be expected which will not appear with a car or home-type receiver.

The antenna may be coupled into the converter by tapping directly into the coil, or by means of the variable impedance antenna coupler as shown in the dual 6AG5 converter schematic (Fig. 2), or by using an antenna coupling coil (Fig. 3). The variable impedance antenna coupling has been used on many other signal boosters, but the author has found the coupling coil gives best results, causing less r.f. input losses and detuning.

The dual 6AG5 converter, like all converters employing grid injection of the oscillator signal, must have the converter tube biased near cut-off or plate current saturation in order to operate on a nonlinear section of the plate curve so that mixing action will



A "design-measurement" setup for use in checking the broadband converter unit.

occur. This type of operation has two disadvantages. With the tube biased near cut-off excessive tube shot effect or random noise output (hiss) occurs, while biasing in the other direction may shorten tube life due to high plate currents, in addition to demanding much more from the d.c. power supply. Further, the tube g_m is practically nonexistent at either of these two bias points, resulting in no amplification of the r.f. signal, merely a mixing action, generally with poor signal-to-noise ratio. Even with the pentagrid oscillator mixing tubes this condition exists due, however, to other factors. Class A biasing of the mixer tube can be employed for the grid injection circuit providing sufficient oscillator power is available to drive the mixer to cut-off on the negative portion of the oscillator cycle. This is not usually possible, and even where possible results in excessive oscillator radiation unless an r.f. stage is employed. With this new circuit background hiss has been lowered sharply but cannot be completely eliminated, except in the presence of a signal, due to the wide range of random noise pickup over the wide r.f. band to which the input stage of this unit is sensitive. A sharply-tuned r.f. stage lowers this type of hiss or random noise but entails another tuning operation and when tried experimentally was not deemed of sufficient merit to be incorporated. It was also noted that this new circuit was more impervious to ignition noise, while the old grid injection unit amplified the strong positive peaks of ignition r.f.

The 6AS6, 6AG5 converter eliminates these factors by employing a new principle described by Vernon Aske of *Sylvania Electric Products Inc.* in his article, "Gain Doubling Frequency Converters," in the January 1951 issue of *"Electronics."*

Fundamentally the biggest change is the method by which the oscillator signal is mixed in the converter tube. The cathode, first grid, and screen of the 6AS6 operate as a class A r.f. amplifier, while the suppressor grid is alternately driven positive and negative by the local 6AG5 oscillator. This results in amplification of the r.f. signal. This change of plate current is then modulated by the r.f. signal applied to the suppressor grid. The sup-

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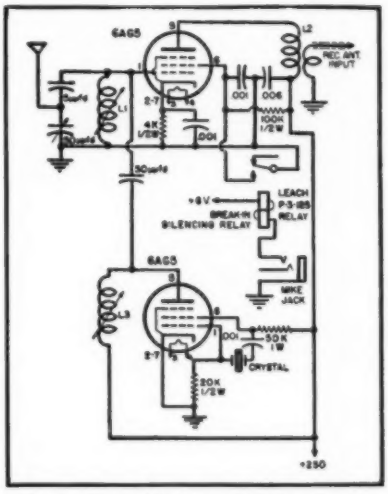
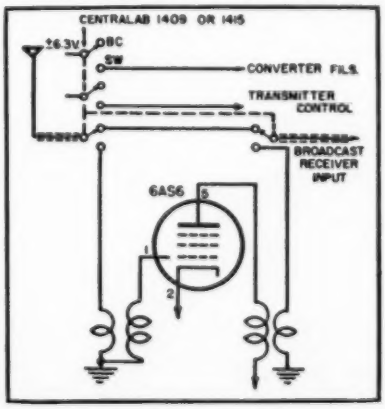


Fig. 2. The original broadband converter as covered in the March 1950 issue. Note the differences between this and the revised version shown schematically in Fig. 1.

Fig. 3. Circuit diagram of the converter's broadcast antenna switching arrangement.



A Novel Multi-Band TUNING CIRCUIT

By
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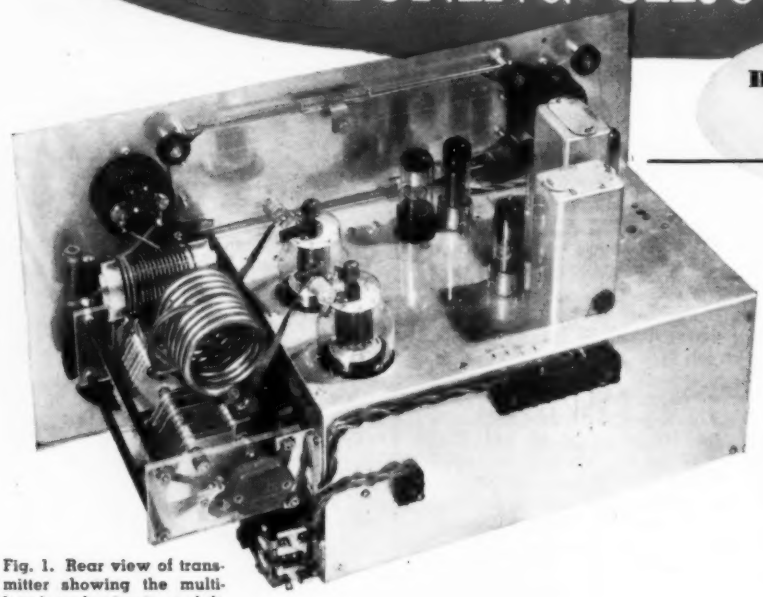


Fig. 1. Rear view of transmitter showing the multi-band tank circuit at left.

A unique bandpass tank circuit permits operation on all ham bands by merely flipping a switch.

THE first multi-band tank circuit developed by the *National Company* several years ago used a four-gang condenser and had two push-pull circuits in series on 14, 21, and 28 mc.[1] Later articles showed the same circuit cut in half and applied to a single stage.[2]

The push-pull version of the circuit with the two push-pull tanks in series has consequently twice the circuit losses of a single push-pull circuit. However, the even harmonics are more or less cancelled out.

The single-ended version, which has the advantage of requiring only a two-gang condenser, has normal circuit losses, but all harmonics are developed equally.

A new multi-band circuit,[3] shown in Fig. 2, uses two tubes which operate in push-pull on 28, 21, and 14 mc. and in parallel on 7 and 3.5 mc. The changeover from push-pull operation to parallel operation is automatically achieved as resonance is reached on each band. Circuit losses are normal as one push-pull circuit is in operation on the higher frequency bands and a single-ended circuit on 7 and 3.5 mc.

In addition, due to the in-phase exciting voltage on the low frequency range, it is impossible to develop harmonics in the high frequency range as the latter tunes only in push-pull.

Hence 3.5 and 14 mc. may tune at the same spot on the scale as well as 7 and 28 mc. The tuning range can be made smaller than with the other published multi-band circuits for this reason.

Many of us have probably applied the principle of this multi-band circuit, though with other coil dimensions.

The circuit is given in Fig. 2. When L_2 is an r.f. choke, this circuit is the well-known push-pull final in which the d.c. is removed from the condenser. L_1 is very small in comparison with L_2 as the latter is usually a 2.5 mhy. choke. For lower frequencies we may say that L_1 puts C_1 and C_2 effectively in parallel to tune L_2 to some very low frequency (say 300 kc.).

Both tubes must be excited in-phase for amplification at this frequency. However, excitation is never applied at this frequency and consequently there is no voltage developed in the output circuit.

However, if L_2 is given a value so that the in-phase resonance falls within one of our lower frequency bands, we then have a single-ended tank circuit and both tubes are automatically in-phase.

With C_1 and C_2 in series, L_1 will resonate from 13.5 to 30.5 mc.; 28, 21, and 14 mc. fall within this range. As the 7 and 3.5 mc. bands also tune 1:2 in frequency, L_2 can be made such that C_1 with C_2 in parallel tune the range 3.45 to 8 mc., covering the two lower frequency bands.

For the low frequency range both tubes operate automatically in parallel and should, of course, get in-phase excitation.

As already stated, the condenser C_1-C_2 tunes through two frequency ranges simultaneously, one range being 13.5-30.5 mc. and the other 3.45-8 mc. To arrive at these ranges the minimum capacitance of the sections C_1-C_2 is of major importance. As the output capacitance of the transmitting tubes is in parallel with the minimum circuit capacitance, it must be taken into consideration. If we can keep this minimum low then the maximum capacity will also be small.

Let's consider the case for a pair of 807's. The output capacity of an 807 is 7 $\mu\mu$fd. An acceptable value of minimum capacity for one section of the condenser is 15 $\mu\mu$fd. For stray capacitances we add 5 $\mu\mu$fd. which brings the total to 27 $\mu\mu$fd. for one half of the push-pull circuit. As our frequency ranges are varying in the ratio 1:2.3 we need a capacity variation of 1:5.3, so the maximum capacity must be 143 $\mu\mu$fd. On the 7 and 3.5 mc. bands, the two sections of the condenser are working in parallel, which doubles the minimum and maximum capacity. The currents through both halves of L_1 are then in-phase and practically cancel the inductance of L_1. This makes it easy to calculate the necessary inductance. When 8 mc. is chosen as the highest frequency, the lowest must be 3.45 mc. for full coverage of both bands. The two ranges can be shifted on the scale by changing the inductance of one of the coils. However, one need not be afraid that harmonics of

the lower frequency bands tune at the same setting as a high frequency resonance. This is due to the fact that on low frequencies both tubes get in-phase excitation and as the high frequencies are all amplified in push-pull at the plates it is impossible to develop any r.f. on the harmonics.

In practice, not even the slightest dip can be detected when the drive is on 7 mc. and the push-pull plate circuit is tuned through 14, 21, or 28 mc. For convenience only, we shift the frequency bands near each other to get a regular scale. However, the frequency ranges can be narrowed a bit if we let the bands overlap. One must bear in mind that for other tubes with a larger output capacity the maximum capacity of each section must be increased as the minimum capacity of the circuit is raised. The circuit may be used only with tetrodes or pentodes, as it is impossible to have proper neutralization on both frequency ranges with triodes. A push-pull final using this circuit is shown at the right in Fig. 4.

The condenser used was a rebuilt *National* TMC 100D, built up to 10 plates on each rotor and 10 on each stator. The metal end plates of aluminum were replaced by polystyrene sheet slightly less than ¼" thick. This was done to lower the minimum capacity of the sections. It also permits wider separation of the two stator sections, since they can be brought closer to the polystyrene plates without increasing the capacity. As the capacitance variation is 1:5.3, every 1 μμfd. reduction in the minimum capacity results in a 5.3 μμfd. decrease in the maximum capacity.

The 14 mc. range is tuned with near maximum (approximately 70 μμfd.) capacity. The circuit losses will be higher than normal due to the higher r.f. currents. For a "*Q*" of 12 we need only 20 μμfd.

To minimize these losses the coil should have low r.f. resistance. A coil of ¼" copper tubing, tuned with 70 μμfd. for 14 mc. (push-pull) will have about a 6 watt r.f. loss when the plate voltage is 600 volts and the estimated power output 70 watts. One can use larger tubing, of course, but for a 100 watt rig, ¼" copper tubing is suitable.

On the lower bands, both sections work in parallel and 250 μμfd. on 3.5 mc. is a suitable value. The wire for the low frequency coil can be either No. 12 or No. 14.

The low frequency coil is tapped onto the middle of the push-pull coil L_{11}, which makes it necessary to have two antenna coupling coils, one for L_{12}, and one for L_{17}. This is no disadvantage, as most hams use different antennas for the low and the high frequency bands. The coils can be selected by means of a switch on the front panel. It can also be accomplished by means of a relay which can be connected by a switch contact fastened to the shaft of the condenser, making contact at places where one of the coupling coils is needed.

In the transmitter described, the bandswitch, which had one unused set of contacts, is used to switch the coupling coil relay.

A transmitter incorporating this tank circuit is shown in the photographs. Operation of this transmitter is very simple as only three controls are required. One knob tunes the v.f.o., one knob operates the bandswitch, while the third knob tunes the multi-band tank.

A five-position, two-section bandswitch is used to select one of the five different bandpass filters and connect it to the grids of the final.

The proper amount of grid drive is definitely fixed by the overcoupled bandpass filters and damping resistors where needed.

When QSYing with this rig, it is only necessary to touch the v.f.o. and the final tuning controls. In contests and traffic handling this is important. The author gave it a fair try in a recent ARRL contest, with gratifying results.

The exciter portion is shown at the left of Fig. 4.

The oscillator grid circuit tunes from 3500 to 3715 kilocycles. In Europe, hams are not permitted to operate on the 27 mc. band. The highest frequency is the eighth harmonic or 29.7 mc., which falls within the range of the oscillator. For the consistent DX man, the lower part of the 80 meter band is not of much interest, and in Europe the band ends at 3800. Without much difficulty one can extend the range to 3800 or even 4000 kc. if necessary. When the range is extended to 4000 kc. the 3500 kc. bandpass filters must be more tightly coupled. All the other filters remain unchanged. The oscillator tube is a 6BX6 in the well-known Clapp circuit. The plate voltage is stabilized with a VR150. The plate is capacity coupled

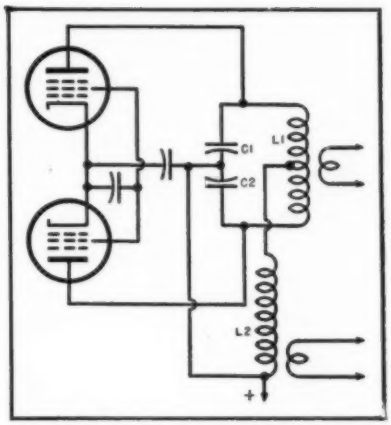


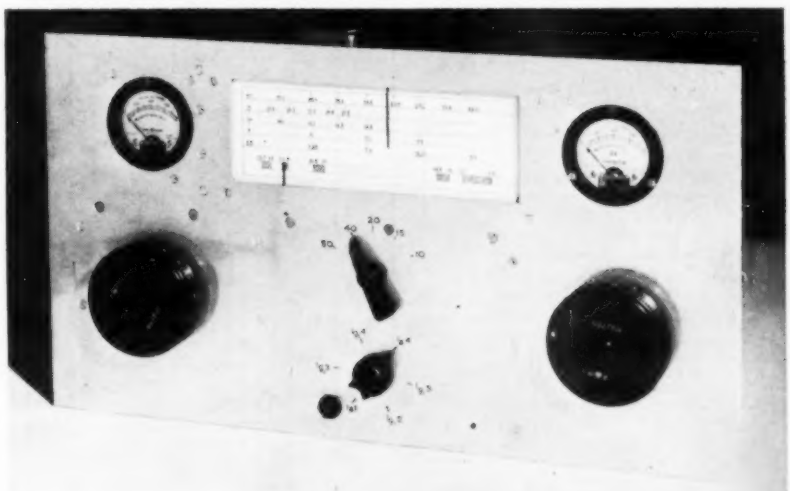
Fig. 2. Diagram of new multi-band circuit.

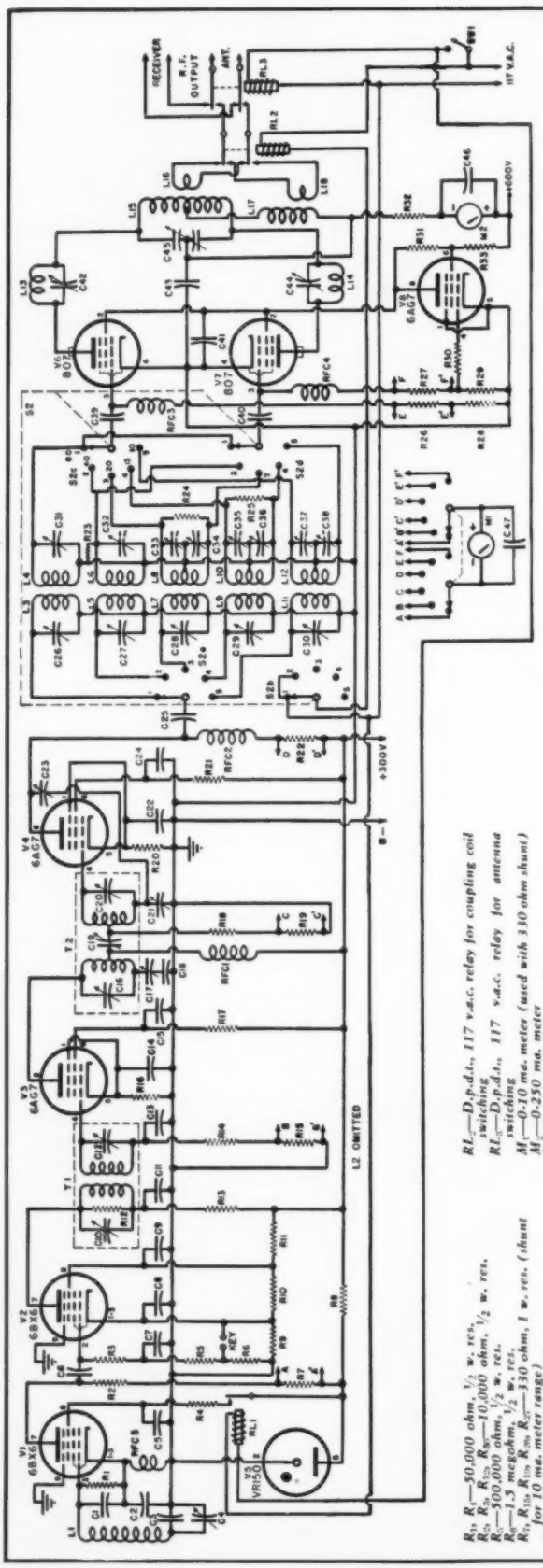
to the buffer stage, which also uses a 6BX6. This buffer stage works in class A and is a very convenient point to apply blocked grid keying. This eliminates a special keyer tube. Grid bias for blocking the grid is obtained by means of voltage divider R_5, R_6, R_9. With a simple *RC* filter, the shape of the keying pulse can be varied to suit the individual user.

Since the stages following the keying stage use cathode resistors, they are biased well within their rated plate dissipation when the key is up. None of them, however, is biased to cut-off. This would be dangerous as it might alter the shape of the keying. Even the final stage is drawing some plate current as the screen grid is connected to relay tube V_3 when the key is up.

The third stage uses a 6AG7. The coupling between the second and third stages is accomplished by a bandpass filter designed for 3.5-3.72 mc. When using tubes like the 6AG7 as an amplifier or frequency multiplier, it is advisable to make the screen bypass ca-

Fig. 3. Front view of transmitter using multi-band tank circuit. The large knob at the left tunes the v.f.o. and operates the upper pointer on the dial. The large right-hand knob tunes the final stage (multi-band tank) and operates the lower pointer on dial. The upper knob in the middle of the panel selects the bandpass couplers while the bottom knob is the metering switch. The panel measures 19"x10½".





R_{51}, R_{52}—50,000 ohm, ½ w. res.
R_{53}, R_{54}, R_{55}—10,000 ohm, ½ w. res.
R_{56}—500,000 ohm, ½ w. res.
R_{57}—1.5 megohm, ½ w. res.
R_{58}, R_{59}, R_{60}, R_{61}—330 ohm, 1 w. res. (shunt for 10 ma. meter range)
R_{62}, R_{63}—20,000 ohm, 2 w. res.
R_{64}—2000 ohm, ½ w. res.
R_{65}—18,000 ohm, 1 w. res.
R_{66}—27,000 ohm, 2 w. res.
R_{67}—1000 ohm, ½ w. res.
R_{68}—100,000 ohm, 1 w. res.
R_{69}, R_{70}—330 ohm, 1 w. res.
R_{71}, R_{72}—16,000 ohm, 1 w. res.
R_{73}, R_{74}—10,000 ohm, 1 w. res.
R_{75}—33 ohm, 1 w. res. (shunt for 100 ma. meter range)
R_{76}—3300 ohm, 1 w. res.
R_{77}—5000 ohm, 10 w. res.
R_{78}—100 ohm, 10 w. res.
R_{79}—15,000 ohm, 10 w. res.
C_1, C_2—700 μμfd., 600 v. mica cond.
C_3, C_4—100 μμfd., 600 v. mica cond.
C_5—50 μμfd. midget var. cond.
C_6, C_7, C_8, C_9, C_{10}, C_{11}, C_{12}, C_{13}, C_{14}, C_{15}, C_{16}, C_{17}, C_{18}, C_{19}, C_{20}, C_{21}, C_{22}, C_{23}, C_{24}, C_{25}, C_{26}, C_{27}, C_{28}, C_{29}, C_{30}, C_{31}, C_{32}, C_{33}, C_{34}, C_{35}, C_{36}, C_{37}, C_{38}, C_{39}—50 μμfd. mica cond. Pushback wire twisted for neutralizing cond. (See text)
C_{40}, C_{41}—200 μμfd., 600 v. mica cond.
C_{42}, C_{43}—4000 μμfd., 1000 v. mica cond.
C_{44}, C_{45}—145/145 μμfd. split-stator cond.
T_1—Bandpass coupler. Pri. 100 t. #31 en., ⅜" dia., ⅞" long (85 μhy.). Sec. 100 t. #31 en., ⅜" dia., ⅞" long, closewound (85 μhy.)
T_2—Bandpass coupler. Pri. 50 t. #27 en., ¾" long (23 μhy.). Sec. 50 t. #27 en., ⅜" dia., ¾" long, closewound. (23 μhy.). Both pri. and sec. are center-tapped.
RFC_{1}, RFC_{2}, RFC_{3}, RFC_{4}—1 mhy. r.f. choke
RFC_{5}—2.5 mhy. r.f. choke
RL_1—S.p.s.t., 117 v.a.c. relay for switching out v.f.o. when receiving
RL_2—D.p.d.t., 117 v.a.c. relay for coupling coil switching
RL_3—D.p.d.t., 117 v.a.c. relay for antenna switching
M_1—0-10 ma. meter (used with 330 ohm shunt)
M_2—0-250 ma. meter
S_1—S.p.s.t. "Send-Receive" sw.
S_2—4-pole, 3-pos. rotary sw.
L_1—V.f.o. coil, 37 t. #22 p.e., 1" dia., 1" long on ceramic form
L_2—Omitted
L_3—14 t. #28 en., closewound on 1¼" dia. form
L_4—28 t. #28 en., closewound on same form as L_3. Space 3/8" between coils
L_5—18 t. #28 en., closewound on 1¼" dia. form
L_6—15 t. #28 en., closewound on same form as L_5. Space 3/8" between coils
L_7—12 t. #20 en., closewound on ¾" dia. form
L_8—17 t. #20 en., closewound on ¾" dia. form
L_9—9 t. #20 en., closewound on ¾" dia. form
L_{10}—14 t. #20 en., closewound on ¾" dia. form
L_{11}—6 t. #20 en., closewound on ¾" dia. form
L_{12}—10 t. #20 en., closewound on ¾" dia. form
Note: L_5, L_6, L_9, L_{10}, L_{11}, and L_{12} to have flexible mounting. See text
L_{13}, L_{14}—12 t. #20 en., 3/16" dia., ¾" long
L_{15}—8 t. ¼" copper tubing, 2¼" dia., 2⅛" long
L_{16}—2 t. #18 rubber insulated wire, 2" dia.
L_{17}—15 t. #14 en., 1½" dia., 1½" long
L_{18}—2 t. #18 rubber insulated wire, 1¾" dia.
V_{13}—6BX6 tube (Philips tube made in Holland but available in this country). A 6AK6 may be used with socket rewiring.
V_{14}, V_{15}—6AG7 tube
V_{16}—VR150 tube
V_{17}, V_{18}—807 tube

pacity no larger than 50 μμfd. This value is sufficient for good amplifying or multiplying and gives a certain amount of negative feedback which stabilizes the stage. Both 6AG7's use 50 μμfd. at the screen grid.

The third stage acts as a doubler to 7 mc. The plate of this stage uses a 7 mc. bandpass filter of unusual design. It is a push-pull job with a capacity connected between the midpoints of the two coils. This capacity does not influence the operation of the bandpass coupler on 7 mc., but acts as a capacitive coupling on 3.5 mc. Hence the d.c. connections to the center taps of the primary and secondary have been made by an r.f. choke and a 100,000 ohm resistor, respectively. The bandpass coupler is enclosed in a screening box, while one of the coils is mounted on a stiff wire so that its position can be varied. The second 6AG7 thus gets excitation on 3.5 and 7 mc. simultaneously.

It is possible to make this tube work as a straight amplifier, doubler, tripler, or quadrupler. The tube gets high bias and sufficient r.f. drive for good multiplying.

On 7 mc. with straight amplification, the stage must be neutralized for adequate stability. We now can profit from an additional feature of the push-pull bandpass coupler, as it has excitation on the secondary which is 180 degrees out-of-phase with the grid voltage. A small capacity of the value of the C_{39} is connected between the plate and the lower half of the grid circuit.

On 3.5 mc., the coupling is strictly capacitive and can be adjusted with the variable condenser C_{39} between the two midpoints of the bandpass coupler. C_{39} should be no larger than is necessary to provide sufficient drive to the grids of the final stage.

It is worth mentioning that for good stability, the bandpass couplers between the second and third stages and

Fig. 4. Complete schematic diagram of transmitter includes a 5-band exciter with a v.f.o. on 3.5 mc. and a final amplifier with the new multi-band circuit. Five band-pass couplers, with bandswitch, are used in the grid of the final. Although it has not been tried, the author suggests that 6AQ5 tubes may give better performance than the 6AG7's shown for V_3 and V_4.

the one between the third and fourth stages should be shielded. The circuits are high "Q" and can pick up r.f. energy from the following stages. The coil of the v.f.o. should also be shielded.

In order to get the most constant drive over the 28 and 3.5 mc. bands, the response of the two bandpass couplers is not the same. T_1, which has a range of 3.5 to 3.72 mc., is adjusted to a little over the critical coupling, and the output voltage falls off at each end.

The second filter, T_2, is overcoupled and has the well-known double-hump response. Both filters combined give a practically straight line response curve of the driving voltage on 7 mc. at the grid of V_4. As the grid leaks are quite high in V_3 and V_5, the grid current in these stages is a proper picture of the exciting grid voltage. Dimensions for the bandpass couplers are given in the parts list. When placing the screening cans over the bandpass filters the coupling is increased. Since this is the case, one of the coils of each coupler is flexibly mounted to permit the best position to be determined experimentally.

The most successful way of accomplishing this is to make the coupling loose and tune both coils to the middle of the band. Then tighten the coupling until the desired response is obtained and then loosen the coupling a little. Now the shield can is replaced and the grid current measured again over the whole range. A little retuning with the shield can in place will sometimes be necessary in order to retain the proper response.

In the final stage (the right-hand portion of Fig 4) we have a bandpass coupler between the driver stage and the final for each band. Each of the five bandpass couplers can be selected with a switch. This eliminates the drawbacks of the other method, as there is only one resonant circuit in the plate circuit of the driver tube. Thus, only one frequency is reaching the grids of the final.

The switch is a five-position, four-pole type. On 3.5 and 7 mc., both grids of the final are put in parallel by interconnecting the fixed contacts of each section. The circuits of the bandpass couplers are both single ended on these frequencies. On both sides of the couplers, the d.c. is removed from the coils by means of parallel feed. For proper division of the driving voltage on each tube of the final, each grid has its own grid resistor. This allows the grid current to be measured separately.

On 28, 21, and 14 mc., the secondaries of the couplers must be push-pull circuits. The coils for these bands are all wound on polystyrene forms and mounted flexibly; *i.e.*, mounted on the polystyrene strips by their leads. This makes the adjustment of the coupling between the coils of each coupler relatively simple.

The push-pull bandpass couplers are mounted around the periphery of the switch and parallel to the axis of the bandswitch. This gives the symmetrical layout necessary for proper balance of the stage.

The 3.5 and 7 mc. couplers are mounted near the front panel with the axis of the coils perpendicular to the axis of the switch.

The midpoints of the secondaries of the push-pull couplers (L_9, L_{10}, L_{12}) should be connected to the midpoint between the tuning trimmers, C_{32}-C_{34}, C_{36}-C_{38}, C_{37}-C_{39}, and then connected to ground. This is necessary as otherwise it is impossible to maintain balance of the grid drive over each tuning range.

To adjust for the necessary amount of grid current in each 807, the secondaries of the couplers were shunted by resistors, R_{23}, R_{24}, and R_{25}.

To keep the screens of the final stage at low potential when the key is up, a variation of the usual hookup was tried. A pentode relay tube is used (V_6) which operates with the screen at a higher voltage than the plate. This is accomplished by connecting the screen grid of V_6 to the junction between the two 807 screen dropping resistors, R_{31} and R_{32}. Convenient resistor values are 5000 ohms and 15,000 ohms. The voltage can be kept down to 7 to 12 volts with different tubes. Any tetrode or pentode can be used as an effective relay tube.

Measurements of the useful output with an input of 110 watts into a pair of 807's show the following figures: 7 mc.—78 watts r.f.; 3.5 mc.—75 watts r.f.; 21 mc.—75 watts r.f.; 28 mc.—75 watts r.f.; and 14 mc.—70 watts r.f. (*Continued on page* 105)

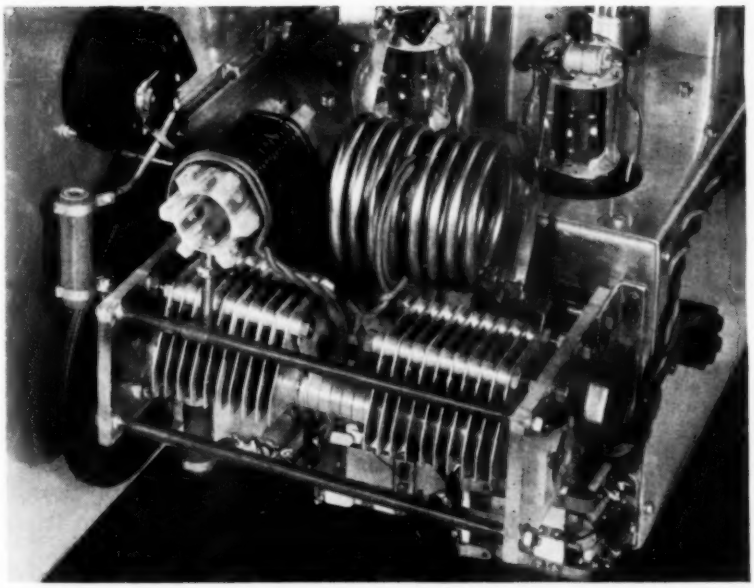


Fig. 5. Close-up view of the new multi-band tank circuit installed in transmitter.

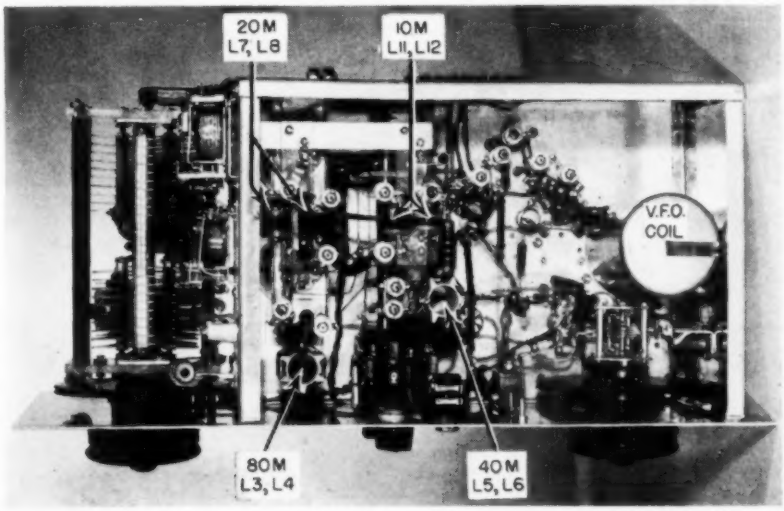


Fig. 6. Bottom view of transmitter. Round can on right is the v.f.o. coil shield.

WHICH TUBE for AUDIO?

By

JOSEPH HOULE

A resumé of the principles involved in selecting tube types for audio output and voltage amplifiers.

WITH hundreds of types of tubes in dealers' catalogues, dozens on the preferred lists, and new types appearing at the rate of eight or ten a week, the hobbyist planning a new piece of gear has cause to feel frustrated and confused. The biggest question is "What's new that's good?" The answer, as far as radio is concerned, is that there are no new types that have been proved to make a really significant difference to the home constructor, but there is a lot of room for experiment.

This article is addressed primarily to the audio enthusiast, and will attempt to cover the elementary principles of selecting tube types for audio output and voltage amplifiers.

If one is primarily interested in building a good music reproducing system for home entertainment, the first rule is to be conservative, and stick to types that have been tried and proved over several years' time. The same, incidentally, applies to circuits. If one is experimentally inclined, there is a host of special-purpose and TV types that offer a promise of higher efficiency, but not drastically higher. Let us consider the standard tubes first.

Power Tubes

Table 1 is a comparison of available power output for several common types of power tubes under arbitrary standard conditions. In some cases it was necessary to interpolate published conditions, since the recommended plate voltage and degree of cut-off differ from type to type. The table, however, is a guide to the type to use for the desired power. The 6V6 triodes are excellent for TV sound and other moderate-level listening in the living room, as noted by Lawrence Fleming in describing a small, high-quality amplifier ("Quality Amplifier for TV Sound") in the May 1951 issue of RADIO & TELEVISION NEWS. 6L6's as triodes are not too desirable, because their high mu limits the power available at moderate plate voltages. If a high voltage is used in conjunction with a tube which is rated to take it, *i.e.*, the 807, we have the famous *Williamson* amplifier. 2A3's and their 6-volt equivalents are good but require a lot of signal voltage on the grids which introduces distortion from the driver stage.

There are several small power pentodes which are similar or slightly inferior to the 6V6, to wit, the 6K6GT, 7B5 (same as 6K6), 6F6, and the older types 41, 42, 2A5. Beam power tubes are essentially improved pentodes, not really different kinds of tubes.

There are no particular variations of the 6L6 designed for audio service, but there are many variations intended for special purposes, all of which work fine for audio: the 6BG6 TV sweep tube, rated for high peak voltages; the 807; the new high-reliability type 5881; the 1619, etc. All have essentially the same characteristics as the 6L6 but differ in maximum voltage rating, plate dissipation, heater voltage, or uniformity.

For low plate-voltage service, such as in a.c.-d.c. amplifiers, we have a series of high-heater-voltage, small beam power tubes. The 25L6 was the first, then the 50L6, identical except for heater resistance. The 35L6 and the miniature 35B5, 35C5 have slightly lower ratings, as do the 50B5 and 50C5. All give an output of about 1.5 to 1.9 watts at 117 plate volts. The 6Y6G and the miniature 6AS5 are 6-volt tubes which give good output at low plate voltage, but have rather high distortion. Only the 25L6, 50L6, and 6Y6G have high enough plate dissipation ratings to permit operation at over 200 volts. All these low plate voltage types are generally considered to have more distortion than the regular tubes designed for operation at 250 volts or more.

Table 1. Approximate outputs of various commonly-used audio power tubes for push-pull operation, 300 volt plate supply, self bias, class AB_1.

TYPE	PENTODE CONNECTION		TRIODE CONNECTION	
	OUTPUT	GRID SIGNAL	OUTPUT	GRID SIGNAL
6V6, 6AQ5	10 w.	12.5 v.	4 w.	25 v.
6L6	20 w.	20 v.	6 w.	35 v.
2A3, 6A3, 6B4G	.....	.....	10 w.	50 v.

Triodes vs Pentodes

Triodes offer the most foolproof way to high fidelity. A good push-pull triode amplifier without any feedback can give excellent performance, but pentodes without feedback are very poor. Pentodes without feedback are used only in home radios and the cheapest p.a. amplifiers.

With about 12 db or more feedback, pentodes can give excellent results. When applying feedback around the output transformer, however, frequency response measurements must be made over a very wide range. The amplifier must be checked for peaks which indicate incipient oscillation at the far ends of the spectrum.

The main advantage of the pentode is its high efficiency, both as to plate input and grid signal voltage. This is very important to a manufacturer because it saves money on parts. To the hobbyist, the money-saving angle may be outweighed by the ease of construction and high reliability of the less efficient triodes. The question of how much power is needed is still moot. Speaker efficiencies vary and published material on this point is rarely available from the manufacturers. It is up to the individual to decide whether he wants high power or not; the first step in any case is to buy a good speaker with a heavy magnet, and determine the power desired for that speaker by means of listening tests.

Plate Curves

The process of calculating power output from the family of plate characteristic curves of a tube is covered in all the books, and explained very well in the *"RCA Receiving Tube Manual."* Rather than go over it here, it may be of interest to point out some of the reasons for tubes doing what

(*Continued on page* 106)

U.H.F. Conversion Methods

By
NOEL EDWARDS

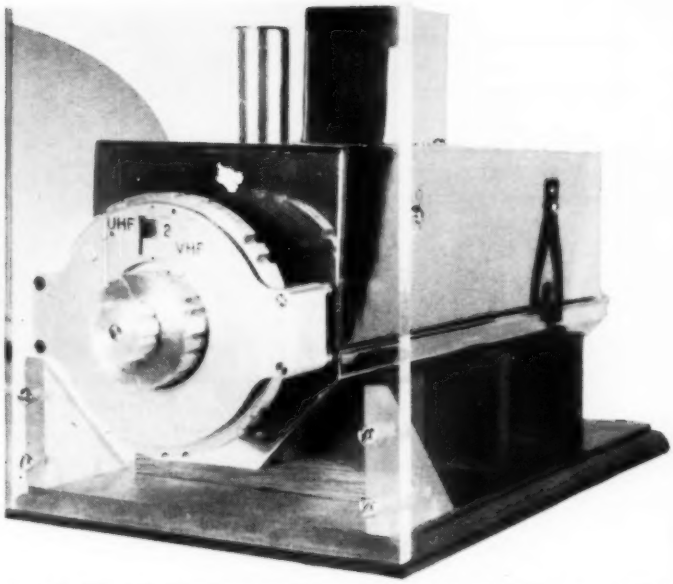


Fig. 1. Standard Coil Company's experimental v.h.f.-u.h.f. 82-channel tuner which uses switched coil-condenser combinations. A two-section dial covers all TV bands.

Part 2. An analysis of some commercially-available converters and a discussion of u.h.f. test equipment.

THE u.h.f converter is basic and uncomplicated. It is easy to install, align, and service. The actual design and production preparation was far more difficult than the adaptation of the converter to a standard v.h.f. receiver.

U.H.F. Tuned Circuits

A number of problems need to be overcome in the development of a tuner-converter for the u.h.f. 470 to 890 megacycle spectrum. The scope of these difficulties is apparent when we consider that this span of frequencies will contain 70 television channels, bringing the total count of v.h.f. and u.h.f. channels to 82. Certainly a 70 or 82 channel selector switch arrangement presents problems in handling over this range of operation. To add to the difficulties, the frequency range is somewhere between the end of the range at which lumped constants can be made to operate efficiently and the range at which microwave practices can be introduced. The choice of tuned circuits and tubes is critical. Tuned circuits take on rather peculiar shapes to obtain the necessary frequency range.

The task of tracking a number of these tuned circuits is present. One-knob tuning of the various resonant circuits requires mechanical ingenuity. The absence of an r.f. stage and the use of a crystal mixer has helped considerably to simplify the tracking problem.

The factors that restrict the use of standard miniature tubes and lumped-constant tuned circuits are tube capacities, lead inductances, and transit time. Tube capacities, small as they might be, present a very low reactance on the u.h.f. band, for example, a 5 $\mu\mu$fd. capacity has a reactance of approximately 40 ohms at 800 megacycles. A small lead inductance has a high reactance on the u.h.f. band. These two factors, therefore, set and limit the highest frequency to which any externally attached resonant circuit can be tuned. Acorns and subminiature tubes show great possibilities because of their smaller parameters (size, capacity, and inductance). The 6F4 acorn and its miniature tube base counterpart the 6AF4 are common in the initial lines of u.h.f. converters. Other tubes which operate well in u.h.f. converter circuits are the 2367A, 1165E, 6BK7, 6B7, and 6V8.

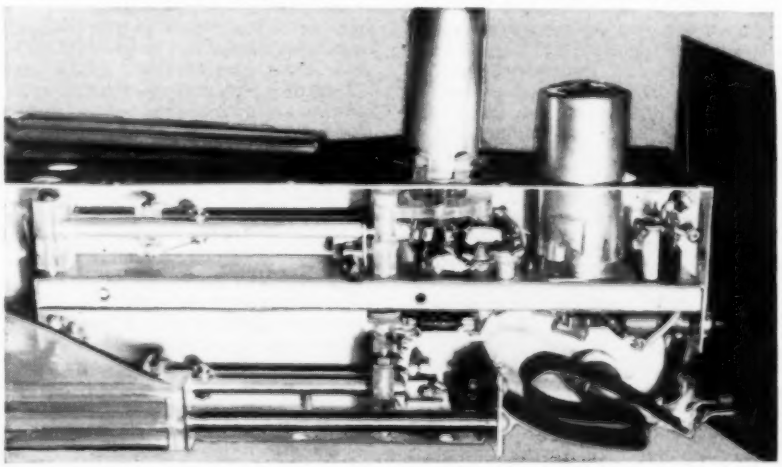
As far as transit time is concerned, it places a low impedance resistive-capacitive shunt across the grid input of the tube, which limits the highest frequency at which a tube can oscillate or function as an amplifier. The transit time loading is caused by in-phase (resistive) and leading (capacitive) components of the grid current. This current flow is the result of the finite time of travel of electrons flowing over the cathode-grid-plate path in the tube. Ordinarily this time of travel is insignificant, but at the u.h.f. frequency it becomes appreciable with respect to the period of the u.h.f. wave. Consequently, the flow of current within the tube can not follow coincidentally with grid voltage changes and grid current flow results.

Tuned Circuit Types

The u.h f. resonant circuit is a critical combination in establishing efficient u.h.f. operation. There will be a number of basic types.

1. Perhaps, initially, the most common type of resonant circuit will be

Fig. 2. The tuned lines as used in the General Electric Company's u.h.f. converter.



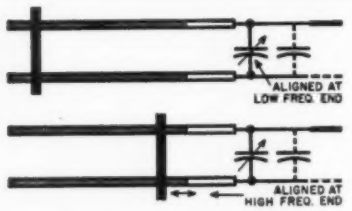


Fig. 3. Tuned lines as resonant circuits.

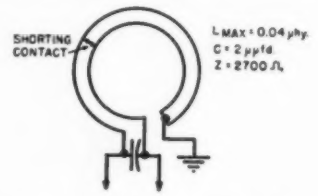


Fig. 4. Tuned lines in form of an arc.

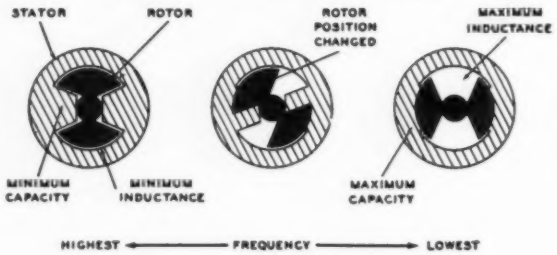


Fig. 5. A "butterfly" type of resonant circuit as used in u.h.f. converter units.

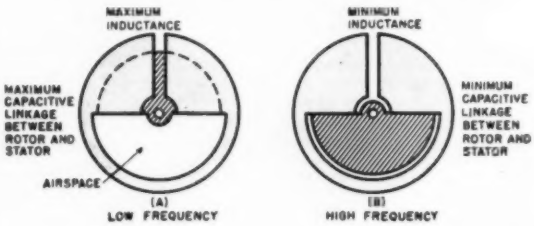


Fig. 6. The basic semi-butterfly circuit. (A) Rotor position at low and (B) high frequency settings.

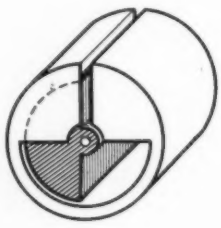


Fig. 7. Cylindrical "butterfly."

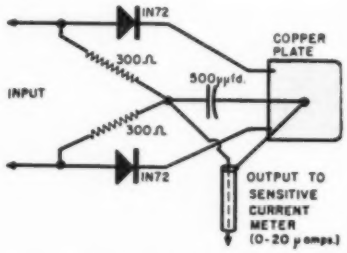


Fig. 8. Output indicator circuit by G-E.

the quarter-wave shorted section of line, Fig. 2. Parallel resonance at a given u.h.f. frequency is obtained by moving a shorting bar along the line. A mechanical arrangement permits simultaneous movement of shorting bars on the two or three tuned lines needed in a typical u.h.f. converter.

Dimensions of the lines must be chosen to permit operation over a wide span of frequencies. The line lengths and lead inductances determine the total inductance of the resonant circuit while the total capacity is a function of the lines, circuit components, and tube capacities. To reach the very high end of the band, the total capacity must be held to a minimum. This means the circuit can then be brought to resonance with a satisfactory value of inductance (though small) to establish a suitable L to C ratio and circuit "Q" at the high end of the band, Fig. 3. Consequently, the high-end frequency limit can be tracked on each line by adjusting for the minimum inductance required to bring the line to resonance with whatever circuit capacity exists. The low-end frequency limit is obtained by using the over-all length of the line and whatever added capacity is needed to reach the low-frequency point with suitable "Q" and bandwidth.

Another factor in the use of lines as resonant circuit elements is the local oscillator which must operate on a frequency lower than the mixer and/or the antenna input lines. Lower frequency range operation can be obtained by changing the dimensions of the line or, if for mechanical reasons it is desired to keep the line dimensions uniform, a tunable capacity can be added across the line High and low frequency end adjustments must also be incorporated to establish proper oscillator tracking and calibration.

Tuned lines can also be formed into an arc instead of stretching out in a straight line. This expedient conserves space and serves as a convenient means of ganging and tracking a number of tuned u.h.f. circuits. In this arrangement, Fig. 9, a shorting contact at the end of an insulated arm slides along the circular lines. In a typical converter, three of these tuned sections with associated arms and shorting contacts are attached to a single shaft to provide continuous tuning over the u.h.f. band.

A typical resonant circuit, Fig. 4, of this type has an inductance of 0.04 μhy. and a capacity of 2 μμfd. or a self-resonant frequency of approximately 530 mc. With just 1 μμfd. of added circuit capacity, the low frequency minimum becomes approximately 460 megacycles, near the low frequency limit of the u.h.f. band. Proper frequency range and tracking is obtained by controlling the width and shape of the tuned line strips of each resonant section. Minor tracking and bandwidth adjustments can be made with small external condensers.

2. The *butterfly* tuned circuit, so named because of its appearance, is an effective high frequency tuned circuit because as the rotor is turned both the inductance and capacitance of the resonant circuit change. Thus a more uniform "Q," bandwidth, and possible tracking can be established. The stator plates of the butterfly, Fig. 5, act as an inductive turn or loop while the rotor acts as both a variable condenser and an inductance shunt. Consequently, as the rotor moves the capacity as well as the inductance of the stator changes.

In its first position the inductance is minimum as the rotor almost completely closes the inductance loop. For example, a flat washer-shaped ring, as opposed to a turn of thin wire with the same circumference, would have substantially less inductance. Capacitance is also minimum in this position as there is the least capacitive linkage between the rotor and stator. This position, then, represents the highest resonant frequency of the butterfly. When the rotor is in a position directly over stator, as in the right-hand drawing of Fig. 5, the resonant frequency is minimum. In this position there is maximum capacitive linkage between the rotor and the two sides of the stator. At the same time the air space in the stator has been opened and there is maximum inductance. The center drawing shows an intermediate frequency point. With this type of tuned circuit both capacitance and inductance decrease when tuning toward the high frequency end, permitting a greater frequency range with a uniform "Q" and bandwidth. Another advantage of this type of circuit is the absence of any moving contacts with their attendant noise and lack of positive contact.

3. A modified or semi-butterfly has been used by *Du Mont* in an experimental u.h.f. converter. With a semi-butterfly, the stator acts as a single turn inductor, Fig. 6, while the rotor changes both the circuit capacity and the inductance of the stator. As illustrated in Fig. 6A, the stator is a single turn coil with an open air space at the

bottom and a definite capacitive linkage between the rotor and the two sides of the stator (each side of the slot). This is the maximum-inductance, maximum-capacitance, low-frequency position. When the rotor is moved through 180 degrees, Fig. 6B, it closes in air space, thus increasing the effective surface area of the stator and lowering the inductance. Likewise, there is a minimum capacitance linkage between the two sides of the stator and the rotor in this position. This is the high frequency limit of the tuned circuit. Other positions of the rotor would tune to intermediate frequencies.

To further lower the minimum inductance, the surface area of the stator turn can be increased into a cylindrical shape, Fig. 7, thus raising the high frequency limit of the tuned circuit still higher. The top of the cylinder can be flattened to provide a mounting position for a tube socket and associated components, Fig. 12.

4. Still another type of tuned circuit is the cylinder type, Fig. 11. It consists of two slotted cylinders, one rotating inside the other. The cylinders represent a simple means of circuit mounting as the tube and components can be connected across the slot of the outer cylinder. As indicated schematically, Fig. 10, one side of the slot is connected to the grid; the other side of the slot is capacitively coupled to the plate.

In a cylinder circuit, the frequency is maximum when the two slots coincide. In this position there is minimum capacity across the slot of the outer cylinder, permitting a very high frequency limit because of the very low inductance of the cylindrical turn. As the inner cylinder is rotated a capacity exists between one side of the outer cylinder and the inner cylinder. The inner cylinder now spans across the slot of the outer cylinder, thus introducing a capacity across the slot. In effect, we have two condensers in series across the slot—each side of the slot to the inner cylinder. The effective capacity across the slot is highest when the inner slot faces exactly opposite to the slot in the outer cylinder. This position represents the low-frequency limit of the tuned circuit.

We can expect to find any one of these basic types of tuned circuits in u.h.f. converters, u.h.f. test equipment, and, eventually, in combination u.h.f.-v.h.f. receivers.

Standard Coil Tuner

Standard Coil has developed an experimental v.h.f.-u.h.f. 82-channel tuner using switched coil-condenser combinations. It is unique because it uses lumped coils and condensers instead of the usual type of u.h.f. tuned circuit. A two-section dial is used, Fig. 1, one section counting in tens, the other in units. To set the tuner on Channel 36, for example, the "tens" dial is set on 3 while the "units" dial is set on 6.

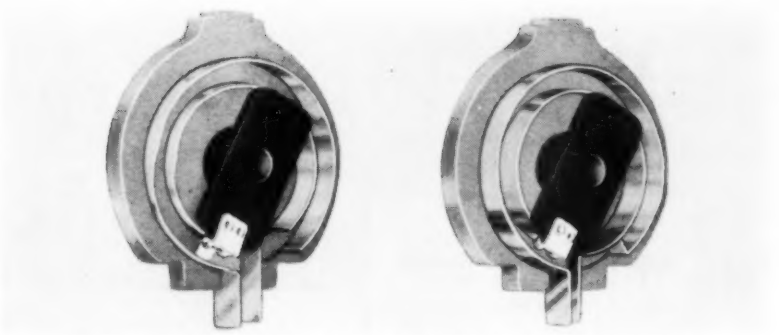


Fig. 9. The tuned circuits used by P. R. Mallory in its u.h.f. converter.

"Tens"	Frequency	Channels
1	470-510	14-19
2	510-570	20-29
3	570-630	30-39
4	630-690	40-49
5	690-750	50-59
6	750-810	60-69
7	810-870	70-79
8	870-890	80-83

Table 1. How the Standard Coil tuner "tens" dial is used to cover the 470-890 mc. range.

The general plan of the tuner, Figs. 13 and 14, is to employ eight specific u.h.f. positions, each approximately 60 megacycles wide, covering the entire 470-890 megacycle range as indicated in Table 1.

Thus the u.h.f. section, in accordance with the "tens" dial setting, opens the input over a ten channel span of frequencies. If the "tens" dial is set on 4, the signal from any channel between 630-690 megacycles reaches the u.h.f. mixer. The choice of the proper one of the ten channels is made by the "units" dial section which sets the frequency range of the tunable cascode i.f. amplifier. The cascode i.f. stage can be set on any one of the ten 6-megacycle ranges that include Channels 7 through 13. For example, the channels from 40-49 could fall in, as indicated in Table 2, using a fixed u.h.f. local oscillator frequency (one fixed frequency out of a choice of eight).

The table indicates that the u.h.f. local oscillator need not be tunable but needs only to be switched to eight preset fixed frequencies (plus some limited variation for alignment or fine tuning). The actual "unit" channel selection is made by shifting the i.f. frequency of the cascode first i.f. amplifier rather than the frequency of the local oscillator.

The output of the cascode i.f. is applied to a second mixer-local oscillator combination (v.h.f. section) and then to the second conventional i.f. amplifier of the receiver.

For v.h.f. operation, the v.h.f. antenna is attached to the input of the cascode i.f. amplifier which selects Channels 2 through 13 with the same calibrated dial and without additional switching. The entire operation is automatic and the user is not aware that v.h.f.-u.h.f. switching has taken place when the dual-dial is changed

(*Continued on page 82*)

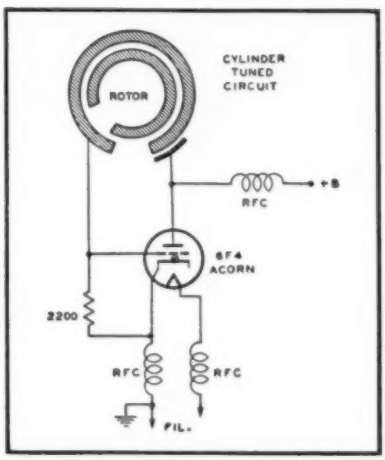


Fig. 10. Schematic diagram of a u.h.f. oscillator with cylinder-type tuned circuit.

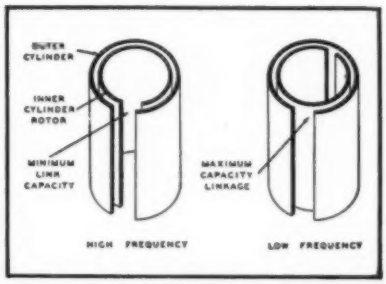
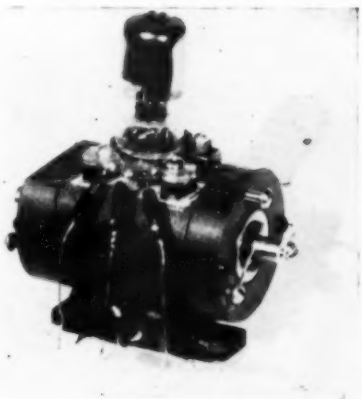


Fig. 11. Cylinder-tuned circuits showing the high and low frequency positions.

Fig. 12. Du Mont's u.h.f. oscillator.



MAP YOUR FRINGE AREA SIGNAL LEVEL

By
EDWARD M. NOLL
and
MATTHEW MANDL

Practical information on measuring and plotting signal levels to facilitate TV installation work.

IN A fringe or near-fringe area service organization, it is important for both the sales and service departments to know the signal level distribution (for each channel) throughout the district. Such information is of help in choosing a suitable receiver, deciding whether or not a booster is necessary, and selecting the correct antenna type for the location.

There has been a definite need for a practical and useful link between propagated signal levels, service type field strength meters, and receiver performance. The signal level "Data-Print" on the facing page, together with the measuring equipment and measurement standards here introduced, represent a practical plan for predicting and solving signal level problems in a given locality.

The charts can be used to predict local channel signal levels as a function of distance. Antenna gain and height can be linked directly to the chart information, thus assuming a more understandable significance. The method of making such measurements is simple and permits the service organization to take sample measurements in its own locality. The information thus obtained can be added to the "Data-Print" charts to give more specific data concerning stations in its own area. The "Data-Print" will then reflect the signal level variations due to terrain differences, climatic conditions, etc. Using the charts, range maps can then be prepared showing the location of specific signal level contours for each station. Finally, a sectionalized map of a single community or district can be prepared with finely calibrated contours and terrain height corrections. Such a map will enable a service organization to select the proper antenna and a booster, if necessary, for any installation without further measurement.

Field Strength Equipment

The equipment used to take the field strength measurements for this article consisted of a field strength meter (the *Transvision* FSM-1A), a power converter, a "Variac," and a folded dipole, mounted on a thirty-foot mast, for each of the channels measured. The power converter was a *Cornell-Dubilier* Model 6R5 which converts 6 volts d.c. to 117 volts a.c. The power plug and cord were the type used with an auto trouble light so the 6 volts for the converter could be obtained by plugging into the cigar lighter receptacle of the car. The "Variac" was used to supply constant voltage to the field strength meter for each measurement. Thirty feet of 300-ohm twin-lead was used between the antenna and the meter. It was found advisable to keep the car engine running whenever measurements were taken to keep the car battery charged.

Measurement sites must be chosen carefully. The antenna used for the measurements must be erected in the clear and away from large metallic objects, power lines, and telephone wires. In urban areas, lots, open fields, athletic fields, etc., are likely locations for taking readings and erecting the mast (use three ten-foot bolted or locked telescoping sections). Fringe area measurements can be conveniently made along the flat stretches of a turnpike and at various distances around the outskirts of small towns. Two ten-foot mast sections on a ten-foot rise or embankment will give the required thirty-foot elevation.

It is important to realize that the more measurements made, the better the variables will average out. This permits construction of a smooth average curve of signal decline because of the many plot points.

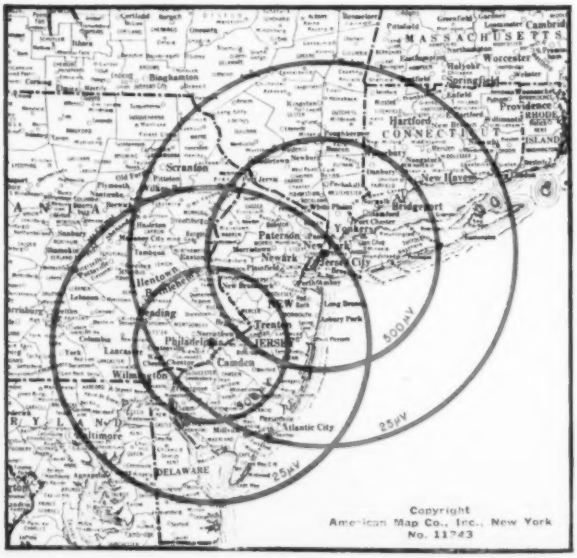


Fig. 1. Signal range map for Channel 5 (N. Y.) and Channel 3 (Philadelphia). The receiving antenna for these measurements was a standard dipole, cut for each channel. For Channel 5, the 500 μv. radius is 60 miles from the transmitter; the 25 μv. radius is 104 miles. For Channel 3, the 500 μv. radius is 38 miles; the 25 μv. circle is the signal level 81 miles from the transmitter site.

Signal Range Maps

The signal decline charts on the "Data-Print" indicate the type of plot that can be constructed for any television area. Measurements were taken and charts plotted for Channels 3 (Philadelphia), 5 (New York), 9 (New York) and 10 (Philadelphia). The chart covers two channels in the low-frequency and two in the high-frequency television bands. For those channels not specifically covered, use the chart for the closest channel. For example, for the signal range of Channel 2, use the chart given for Channel 3; for Channel 7 use the Channel 9 chart, etc. The strength of the signal (in microvolts) can be obtained by taking a few sample measurements in your area and using the signal decline charts to predict signal levels at any given distance. For ex-

(*Continued on page* 55)

ample, if the signal level obtained from your local Channel 5 station is only 500 microvolts at fifty-three miles instead of the 1000 microvolts (refer to Channel 5 signal decline chart), the entire microvolt scale is simply halved. The microvolt scale is changed by whatever ratio exists between actual and chart readings for the range at which the sample measurement is made.

The signal range maps are constructed from the information given in the signal decline charts. Each contour represents a certain signal strength for a particular station at a given distance from the transmitter location, as obtained from the chart for that station. The first signal range map (Fig. 1) depicts 500 and 25 microvolt contours for New York's Channel 5 and Philadelphia's Channel 3. These signal levels represent actual microvolts applied to the input of a receiver or to the 300-ohm input of a service type field intensity meter that has been calibrated accurately. It should be noted that similar microvolt contours for New York's Channel 5 and Philadelphia's Channel 3 are at different distances from the station. This is a result of different erp's, antenna heights, and terrain conditions. Thus, the factors of erp and transmitting antenna height have appreciable significance in the fringe range of a station.

An explanation of the 500 and 25 microvolt choice is instructive. For the average television receiver manufactured during the last few years an input signal of 1000 microvolts (at the tuner input) was the level at which the receiver noise became apparent by very close observation of the line structure of the picture adjusted for normal contrast (first appearance of faint snow effect). When the signal level is at 50 microvolts, the snow effect is severe and the picture is near a point at which it cannot be considered tolerable for satisfactory viewing. With the new cascode low-noise type of tuner, levels of 500 and 25 microvolts are a better approximation. The maps show extended range possibilities of lower noise levels. It is true that these noise conditions vary from receiver to receiver and from channel to channel. Nevertheless, the values chosen represent an ultimate practical value.

In summary, such maps will tell you, as a function of channel (low or high band) and erp of station, etc., the approximate microvolts of signal that can be expected at the receiver input at a given distance from the station.

The logic behind the choice of a dipole reference is demonstrated in Fig. 2. Normally, gain figures of various commercial-type receiving antennas are given (or should be) with reference to the signal delivered by a standard dipole. For example, if an antenna with a gain of 6 db was used instead of a reference dipole in the case of New York's Channel 5, there would be twice as much voltage at the receiver input for each of the contour distances from the station. Likewise, readings taken from the microvolt scale on the signal level chart for Channel 5 on the "Data-Print" must be doubled. This indicates that the actual contour values of Fig. 1 are further separated from the station transmitters as a function of the gain of the antenna.

This range extension factor is demonstrated in Fig. 2 for a conventional conical-reflector type of antenna with a gain of 3.5 db on Channel 5 and 2.5 db on Channel 3. Just how much farther the contours fall can be calculated from the signal level charts on the "Data-Print." Simply raise the curve by the db gain introduced by the antenna and read the microvolt-distance figures directly off the chart for the new curve. With these new figures, draw the new contour. The service organization can follow this same procedure for whatever type antenna used.

For example, the 500 microvolt contour for Channel 3 is 38 miles out, using a standard dipole with the measurement standards specified. This point on the chart is at the —26 db level (chart 1). With a conical-reflector at this distance, the signal level at the receiver would be 1.33 times 500 or 665 microvolts (2.5 db antenna gain). The actual 500 microvolt level for the conical-reflector would be located at a distance represented by a signal decline of 28.5 db (26 plus 2.5). On the chart, this level is located at the 40½ mile point.

The New York's Channel 9 portion of Fig. 3 shows the 500 and 25 microvolt points for this station. Notice that these contours are nearer to the station location than they were for the low-band stations although transmitting powers are higher.

To demonstrate further the influence of antenna gain on microvolt contours, the Channel 10 (Philadel-

(*Continued on page* 64)

Fig. 2. A signal range chart for Channel 5 (N. Y.) and Channel 3 (Philadelphia) using a conical reflector receiving antenna to obtain the readings. Channel 5, whose transmitter is at the Empire State Building, delivers a 25 μv. signal over a radius of 112 miles and a 500 μv. signal at a radius of 64½ miles. Channel 3 (which is transmitted from a suburban Philadelphia location) delivers a 25 μv. signal at a radius of 90 miles and a 500 μv. signal at a distance of 40½ miles from the transmitter as shown by the concentric circles on the chart.

Fig. 3. Signal range map for Channel 9 (N. Y.) and Channel 10 (Philadelphia). For Channel 9, the 500 μv. radius is 41 miles from the transmitter; the 25 μv. radius is 76 miles. The 50 μv. radius for Channel 10 was determined using dipole, conical reflector, and yagi antennas. The circles show the effect of using succeedingly higher gain antennas. The yagi antenna will supply the receiver with a 50 μv. signal at 68 miles from the transmitter; the conical reflector at 62 miles; and the standard dipole will provide this figure at a distance of 49 miles.

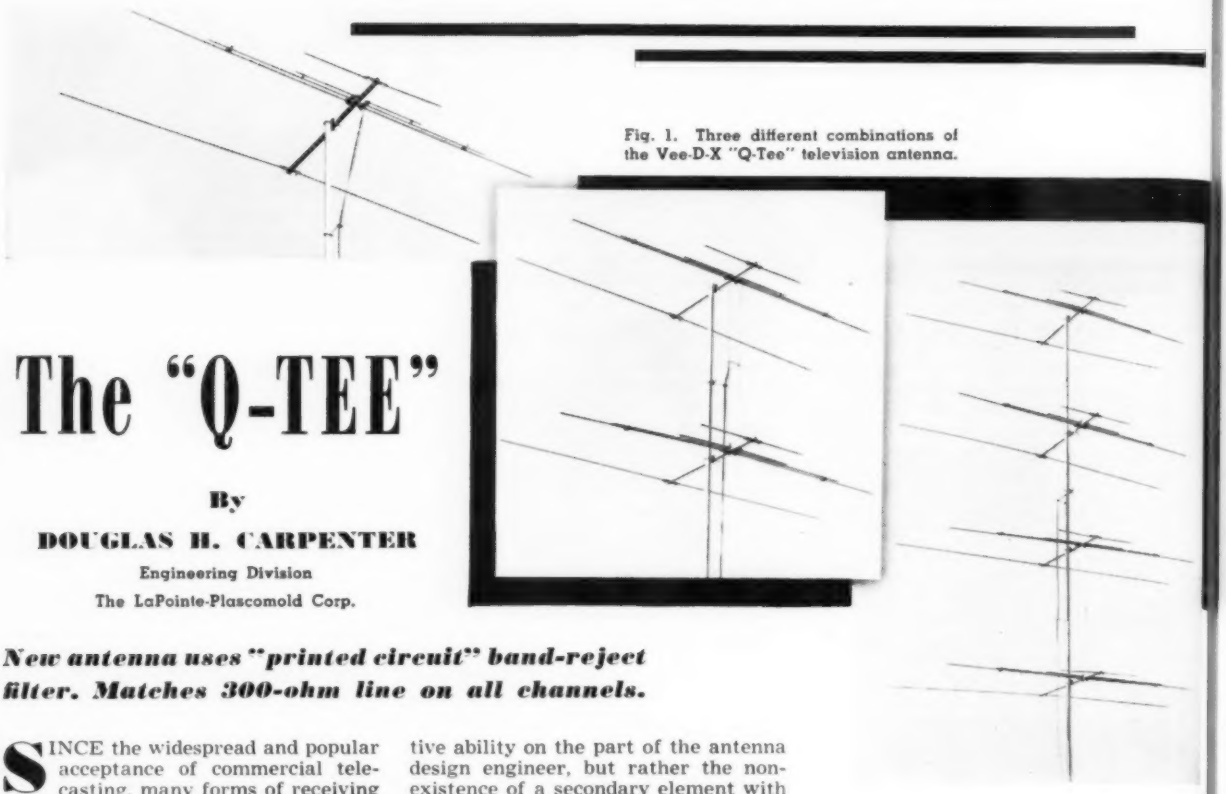


Fig. 1. Three different combinations of the Vee-D-X "Q-Tee" television antenna.

The "Q-TEE"

By

DOUGLAS H. CARPENTER

Engineering Division

The LaPointe-Plascomold Corp.

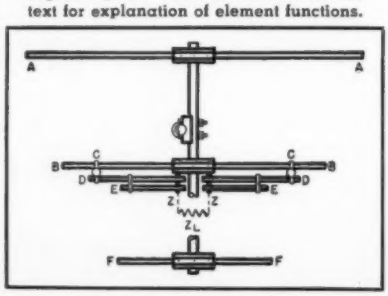
New antenna uses "printed circuit" band-reject filter. Matches 300-ohm line on all channels.

SINCE the widespread and popular acceptance of commercial telecasting, many forms of receiving antennas have dotted the nation's landscapes. Progress in the art of antenna design has, unfortunately, revolved around variations of a limited number of basic forms. These have been well known to the engineer long before the manufacturing of television antennas became the great industry it is today. Gradual standardization by service technicians across the country resulted in the selection and purchase of two specific types to satisfy two entirely different installation requirements. Metropolitan and near fringe reception dictates the use of a broadband antenna that will receive all channels and maintain a fixed directivity pattern. The second requirement is that of the fringe installation (or single-channel area) where it is necessary to obtain as much power gain on one channel as possible. For this situation there is no substitute for the yagi. There are, of course, other types being used, but for the same amount of material it is practically impossible to get equal results. For reasons of gain, assembly convenience, and all-around performance, the yagi is pretty well entrenched as the undisputed champion of single-channel reception. It is fairly unlikely that another antenna will be developed to supplant the yagi in its specific job. Research intensified by television demand has not as yet produced a superior type or even a good rival.

It might be well at this point to state that the greatest reason for the absence of new models in the antenna field is not a lack of research or creative ability on the part of the antenna design engineer, but rather the non-existence of a secondary element with which he may work. The electronic design engineer concerned with circuitry, for instance, will many times create a new improvement in the art. First, because of careful forethought, and second, because he is working with a flexible set of constants that may be rearranged in form and function. Up until now the antenna engineer has had at his disposal only one element, conductive material. This basic limitation has always confined such engineering activity to improvement of existing forms, rather than development of radically superior types.

To review progress in the field of broadband reception, we again observe a well-known form in new dress. The conical, or derivation of the "V" antenna, has been pretty generally accepted as the type that should be used where both high and low channel reception is desired. The conical works on the old and well-known principle of electrically enlarging the receiving element to lower its "*Q*" and broaden its effective frequency response. This is accomplished by fanning out the receiving elements so that their individual fields intercouple when excited by a signal. This arrangement simulates a more or less "filled in" area similar to a large diameter tube. The purpose of tilting the receiving elements forward is to superimpose the major third harmonic lobes so they add in voltage and present good directivity on Channels 7-13. In all broadband antennas, an increase in performance in one part of the spectrum usually results in a loss at some other frequency. In the case of the conical, tilting of the elements results in a broadening of the directivity pattern on Channels 2-6 with resultant loss of gain and with increased susceptibility to interference and reflected signal pickup.

Fig. 2. "Q-Tee" construction details. See text for explanation of element functions.



A markedly new approach to the problem of broadband reception has been developed by the *Vee-D-X* engineering staff, at long last employing the "secondary element" to achieve outstanding electrical performance. The "secondary element" has been nationally described as an "electronic channel separator," but in radioman's language is actually a specialized form of band-reject filter. The ratio of *L* to *C*, and the "*Q*" of the di-electric material, have been very carefully combined to work between the individual impedance points of separate receiving elements, and to provide a high insertion loss throughout the range of 160 to 230 mc. In the range

of 54-88 mc., the residual short circuit impedance (inductive) of the filter is extremely small and, as will be pointed out later, is actually used to balance the match to the low channel receiving element. The total filter is printed to maintain proper circuit "*Q*", and to insure electrical similarity between all units. The printed circuit and connecting lugs are housed in a sealed case of polystyrene. The printed filter and housing are illustrated in the photograph of Fig. 5. In final assembly the filters are connected between elements *B,B* and *D,D* at points *C*.

The electrical function of the total antenna can be explained by reference to the drawing of Fig. 2. If the operation of the high frequency section is considered first, we may forget about the low frequency reflector *A*. Element *D,D* is a full-wave antenna (half-wave each side) resonant at the center of the high channels. Element *E,E* is a "T" matching transformer, and element *F,F* the high channel director. Z_L is, of course, the transmission line impedance to be matched throughout the entire range. A full-wave antenna has a center impedance on the order of 2000 ohms making it an impractical match to standard 300-ohm ribbon line. A full-wave antenna has, on the other hand, a voltage gain of 1.4 over that of a half-wave dipole. Between the center feed points of a full-wave antenna and the opposite ends, the impedance varies from the 2000 ohm value to a theoretical 0, and then back to a high value again. The problem was to tap into the proper points in element *D,D* through the matching transformer *E,E* to get a proper match to the line while retaining the high power gain of the full-wave antenna. The high-channel director *F,F* was purposely designed as an electrical half wave. If a full-wave director were used, the center impedance of the full-wave antenna would increase with coupling and the points of theoretical 0 would be higher than those practical to match through the "T" transformer system. The band-reject filters *C,C* isolate the points of contact between elements *D,D* and *B,B*. Thus we have, essentially, a "T" matched full-wave antenna with a half-wave director. This combination by itself should not provide broadband reception, nor should it necessarily have high gain or a particularly sharp directivity pattern. As happens once in every 10,000 electronic experiments, it was discovered that we had something more than calculated; an extremely broad response, and the maintenance of a sharp directivity characteristic over the entire high-channel range. Further analysis of the intercoupling effects of the total assembly indicated a high degree of proximity coupling between the low-channel receiving element, high-channel receiving element, transformer elements and high-channel director. As can be appreciated, a mathematical explanation of this phenomenon is necessarily complex, since conditions change radically as frequency is varied throughout the high-channel range. A simpler explanation, which is generally correct, is to say that because of this coupling we have accomplished an effect very similar to that which exists in the conical; an electrical enlarging of *all* controlling elements resulting in lowered "*Q*" and consequent broadband characteristics. Reference to Fig. 3 tells the story on the high channels. The graph of Fig. 3 shows comparative curves plotted for average responses of the conical type antenna *vs* the "Q-Tee" throughout the range of 174-216 mc. The comparative horizontal directivity patterns for the two are shown with the conical antenna patterns in solid lines and the "Q-Tee" dotted.

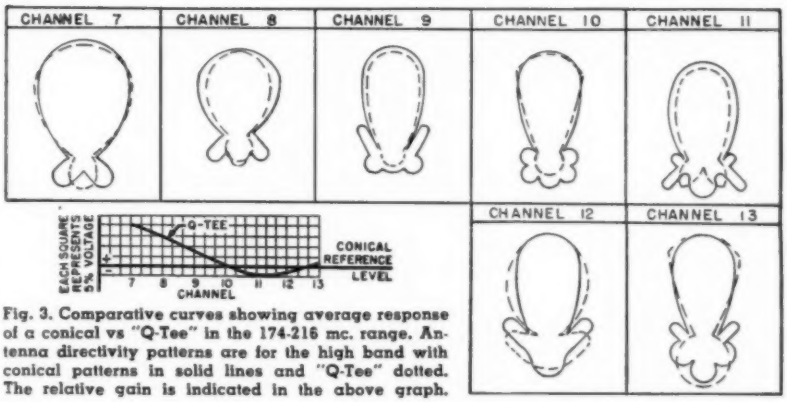


Fig. 3. Comparative curves showing average response of a conical vs "Q-Tee" in the 174-216 mc. range. Antenna directivity patterns are for the high band with conical patterns in solid lines and "Q-Tee" dotted. The relative gain is indicated in the above graph.

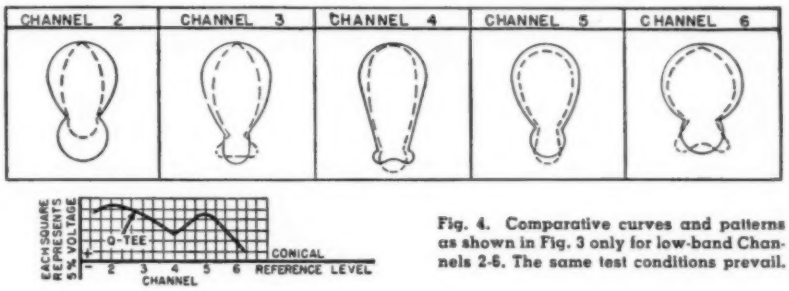
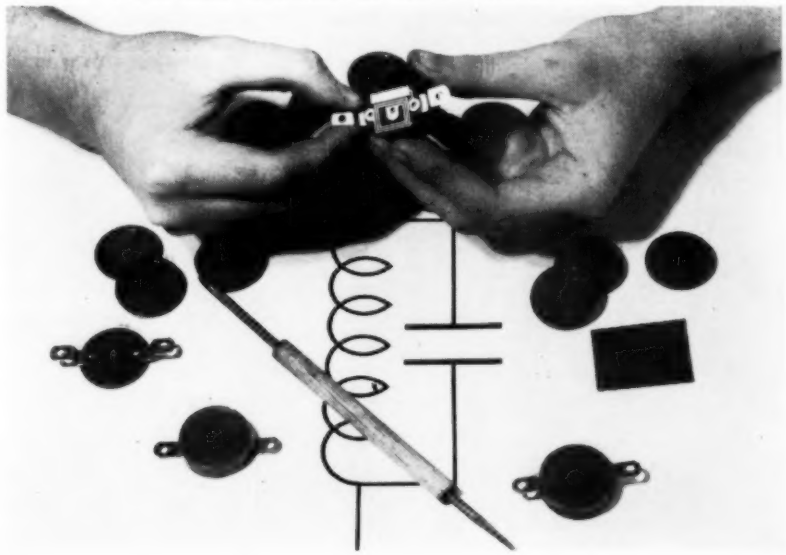


Fig. 4. Comparative curves and patterns as shown in Fig. 3 only for low-band Channels 2-6. The same test conditions prevail.

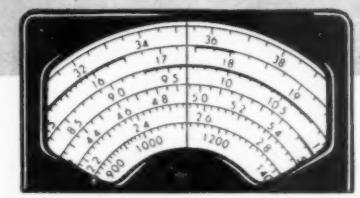
Operation on Channels 2-6 requires a little mental orientation as to the electrical function of the high-channel receiving elements just described. In this range we are primarily concerned with the half-wave, low-channel receiving element *B,B* and half-wave reflector *A,A*. Again, by itself, this combination could not be considered a broadband array. Starting from the transmission line feed points *Z,Z* elements *E,E* and *D,D* now become a

(*Continued on page* 109)

Fig. 5. "Printed circuit" band-reject filter used by Vee-D-X in the "Q-Tee" antenna.



International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

THE World Friendship Society of Radio Amateurs will welcome magazines and other periodicals of any kind—technical or recreational—for its "Bedfast Club" members; QRA is WFSRA, % Bob Kenny, 30, Churchbury Road, Enfield, Middlesex, England. WFSRA now has a Membership Chairman to whom all inquiries regarding membership should be sent—E. Mitchell, 27, Fir Close, Willand Nr. Cullompton, Devon, England.

Sweden—A new DX club is "Never B4 12," Ostervagen 24, nb, Selna I, Sweden; chairman is Gunnar Karlsson. (Radio Sweden)

USA—The annual outing of the United 49'ers Radio Society will be held on Sunday, July 27, at the home of President Edw. Broome, Vincentown, New Jersey; all members and friends are invited to attend. The Maple Leaf Chapter will hold its outing on Sunday, July 27, at the home of Director Robert (Bob) Vance, 117 Wellington Street, North Woodstock, Ontario, Canada. (Boice, Conn.)

The 1952 Summer Convention of the Newark News Radio Club was held Sunday, June 22, on the grounds of the Montgomery County Sportsmen's Club, Green Lane, Pa.; the committee in charge was headed by Dick Daneker, Lansdale, Pa., and Vincent C. Stasen, Philadelphia, Pa. The NNRC recently chose these officers—Irving R. Potts, Union, N. J., president; G. Dudley Clarke, Verdun, Quebec, Canada, Canadian vice-president; Walter L. Townley, Little Falls, N. J., treasurer; Albert J. Sauerbier, Jersey City, N. J., executive secretary; Benjamin Feinstein, Hillside, N. J., assistant executive secretary; Peter J. McKenna, Albuquerque, N. M.; Henry T. Tyndall, Burlington, Vt.; Louis Hahn, Rutherford, N. J.; Roger Legge, Jr., Scarsdale, N. Y.; Harold W. Robinson, Green Lane, Pa.; Abe Cohen, Seattle, Wash.; Charles S. Sutton, Toledo, Ohio; Eugene S. Allen, Vallejo, Calif.; Charles P. Atherton, Exeter, N. H.; Earl R. Roberts, Indianapolis, Ind.; Sheldon Dunham, Jr., Cary, N. C.; and Harold S. Williams, Seymour, Conn., all vice-presidents.

Due to press of business interests, Don Gross, Oregon, has had to give up his position as short-wave editor for the Universal Radio DX Club; he has been succeeded by Marvin E. Robbins, 5230 Cornelius Ave., Indianapolis, Ind., according to Charles Norton, Hayward, Calif., president of URDXC.

* * *

This Month's Schedules

Albania — Radio Tirana, 7.852A, still has news 1615. (Pearce, England)

Algeria—Radio Algerie, noted with good signal 1430 in Arabic, and signing off 1800 with "La Marseillaise." (DX-Radio, Sweden) Is again using 9.570 in French 1300-1800 while 6.145 carries Arabic on the same schedule. (Pearce, England)

Andorra—Radio Andorra, 5.995A, noted 1300 with popular recordings.

These buildings house "Radio Tetuan," Spanish Morocco. It operates on 6.037 mc.

(Lepple, Germany, via URDXC) Heard in Scotland around 1607-1623 with light music. (Rodger)

Anglo-Egyptian Sudan — Although the station claims use of 7.325 for experimental purposes, has been heard on 7.380-7.385 by Pearce, England, on Fridays 1230-1300 with the weekly *English* period.

Angola — Luanda, 11.862A, closes 1730 weekdays, 1530 Sundays. (Niblack, Ind.) Heard in Sweden parallel on 9.632 around 1600. (*NATTUGGLAN*, Sweden) In verifying, also listed 7.142. (Kary, Pa.) CR6RJ, 10.050A, *Radio Clube de Huila*, Sa da Bandeira, noted 1450 when tuned; signed off 1530A with "A Portuguesa." CR6RB, 9.165, Benguela, noted 1310 to *after* 1445. (Pearce, England)

Argentina — Latest schedules for SIRA sessions include LRA, 1030-1230 in Portuguese for Brazil, 17.720; 1235-1530 in French, 17.720; 1605-1700 in German, 17.720; 1730-2030 in *English* for Eastern North America, 17.720; 2100-0100 in Spanish for the Caribbean, 15.345. LRU, 1300-1400 for Spanish America, 15.290; 1400-1545 in *English* for Great Britain, 15.290; 2300-0100 in *English* for Western North America, 15.290. LRS, 0800-1300 in Portuguese for Brazil, 11.880; 1300-1400 in *English* for Great Britain, 11.880; 1400-1500 in Swedish, 11.880; 1505-1600 in Italian, 11.880; 1605-1700 in German, 11.880, and 1700-0100 in Portuguese to Brazil, 11.880. (Golden, Mass., others) LRS2, 9.320, noted in Spanish 1914. (O'Sullivan, England) LRX, 9.66, heard at high level around 2022-2102. (Oestreich, Wash. State)

Austria — Blue Danube Network, 5.080, Salzburg, noted with music 1440-1500. (DX-Radio, Sweden) Heard on 9.617 with request program 0700. (O'Sullivan, England)

Azores—CSA92, 11.090, Ponta Delgada, noted on summer schedule of 1400-1500. (Ferguson, N. C.)

Bechuanaland—ZNB, 8.230, Mafeking, is heard in Germany around 1500 using *English;* bad CWQRM. (Lepple, via URDXC)

(*Continued on page* 92)

(Note: Unless otherwise indicated, all time is expressed in American EST; add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.)
The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given. "A" means frequency is approximate.

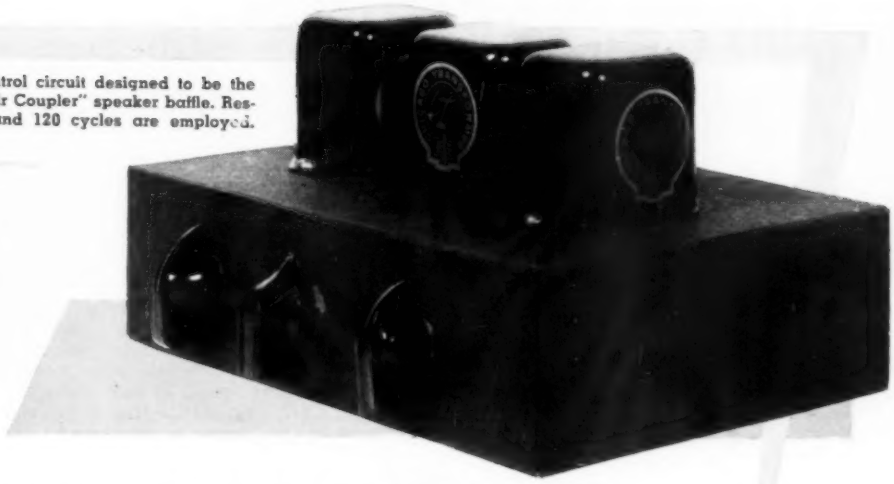


Fig. 1. Experimental bass control circuit designed to be the electrical counterpart of the "Air Coupler" speaker baffle. Resonant frequencies of 40, 60, and 120 cycles are employed.

PULSES IN SOUND REPRODUCTION

By GLEN SOUTHWORTH

Methods of pulse control and pulse broadening used to improve the bass reproduction in audio equipment.

IN THE early development of sound reproducing equipment a number of detailed studies were made regarding the characteristics of the tones produced by various musical instruments. These studies, usually made with equipment employing selective resonant circuits, indicated that many orchestral instruments produced prominent harmonics or overtones and, in frequent instances, were accompanied by relatively wide-band noise components. As a logical consequence, it was believed that natural sounding reproduction would require a system having relatively flat static frequency response characteristics over a wide range in order to obtain proper emphasis of important harmonic components.

Unfortunately for the development of the audio art, data supplied by a wave analyzer may be interpreted quite differently than that supplied by an oscilloscope. Where a wave analyzer may indicate a fundamental tone with strong harmonics, an oscilloscope may show merely a series of simple pulses. Similarly, wide-band noise, indicated by a wave analyzer, may show up on an oscilloscope screen as a single or group of nonperiodic pulses. As a result, the fact that an audio system has good static frequency characteristics is no guarantee that it will accurately reproduce "harmonics" or noise sounds, in fact many of the expedients used to obtain wide-band response make it certain that accurate reproduction of pulses will not be achieved.

Although transient response has received increasing attention in recent years, it has been largely identified with the reproduction of sounds such as those produced by the timpani, cymbals, or the so-called noise instruments. Actually, the sounds produced by such instruments are usually fairly long damped wave trains which, due to their duration, can be reasonably well reproduced by equipment having a moderate amount of electrical or physical inertia. A somewhat more serious problem may be encountered in the reproduction of instruments that produce a reasonably steady tone with pulse-like characteristics. In this classification fall nearly all of the instruments in the lower register, even the organ, and the inability of much reproducing equipment to handle this type of transient is very often the cause of the frequent complaint of poor bass reproduction.

In dealing with the reproduction of pulses there are a number of very interesting characteristics that may be observed. Probably the most important of these is the way in which the pulse shape is strongly influenced by its acoustic or electrical environment. For example, the initial tone produced by strings or horns may consist of a series of relatively narrow pulses, which when heard at close range may sound relatively weak and colorless due to the transient characteristics of the listener's ear. However, when such instruments are played in a large room, such as a concert hall, wall reflections may arrive at the listener's ear in sequence, producing the effect of a much broadened pulse, such as shown in Fig. 2C. The broadened pulse approaches the characteristics of a sine wave and therefore has both increased depth of tone and greater loudness. The pulse broadening produced by acoustics makes it possible to simulate very low frequency fundamental tones from an instrument with relatively limited radiating area and is a very important factor in apparent bass characteristics and auditory "balance" between different sections of an orchestra.

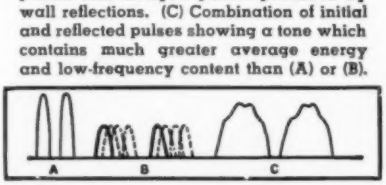


Fig. 2. (A) Initial pulses generated by musical instrument or other source. (B) Initial pulses and delayed pulses produced by wall reflections. (C) Combination of initial and reflected pulses showing a tone which contains much greater average energy and low-frequency content than (A) or (B).

Another interesting characteristic of pulse waveforms is the fact that the peak amplitudes involved are frequently much *less* influenced by acoustics than are the peak amplitudes of sine waves. In the case of pulses, wall reflections either mean pulse broadening or occasionally pulse narrowing, while in the case of sine waves wall reflections usually mean reenforcement or cancellation of peak intensities, with cancellation problems becoming serious at low frequencies where room dimensions become comparable to the wavelengths of the generated tones. This factor has apparently influenced the design of musical instruments and even in the case of organs low frequency tones may be modulated at a rate of from three to eight cycles-per-second in order to reduce the effects of destructive interference from wall reflections.

Turning to the problems involved in reproducing pulses, probably the major one encountered is due to the physical

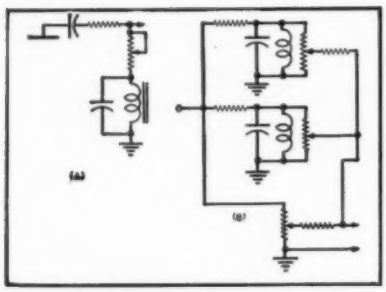


Fig. 3. (A) The simplest method of using a resonant circuit for bass boost and pulse broadening. (B) One of the methods of mixing several resonant circuits which are tuned to different audio frequencies.

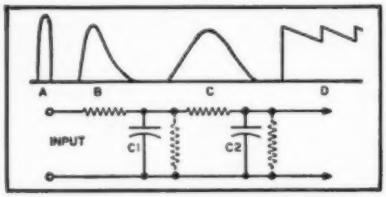


Fig. 4. How acoustic pulse broadening is simulated by simple RC circuits. Initial pulse at point A is transformed into a saw-tooth type waveform at B by the relatively slow discharge of condenser C_1. The slow charging characteristic of condenser C_2 tends to round off the initial steep slope of the saw-tooth resulting in waveform shown at C. D is the distortion that may occur if the discharge rate of condensers is too slow. This may cause a subsonic component in output capable of causing distress in the following amplifier stages or the loudspeaker. The resistance shown in the broken lines may be employed to reduce this particular effect.

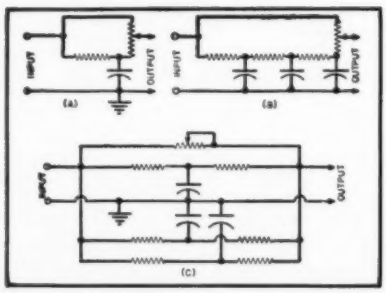


Fig. 5. Several of the many possible methods of obtaining pulse broadening with RC networks. (A) Variation of a conventional bass-boost circuit. (B) Delay line with considerable amount of phase shift which can be used to attenuate low frequency sine-wave response while passing pulses and short-duration transients. (C) Combination of several circuits such as in (A) but with different time constants for maximum effectiveness over a wide range.

Fig. 7. Several known types of speaker baffles in which back radiation is used and influences reproduction of pulses. The acoustic delay path is shown dotted.

inertia of the loudspeaker, which causes pulses to be reproduced at a considerably lower level than sine waves and also can lead to serious deformations of the pulse's initial shape. Undoubtedly a large number of listener complaints regarding "one-note bass" or speaker "boom" can be traced to the pulse distortion produced by the speaker system. Two reasons for this are the fact that the speaker's pulse response will usually be best at or below its primary resonant frequency, and secondly, pulse broadening may be produced by speaker resonance or baffle arrangements. The result of these effects is that pulses having a repetition rate related to the frequency of the speaker or cabinet resonance may be reproduced at an intensity far above that of tones which do not bear such a relationship. In the reproduction of a badly distorted recording this factor will also apply to originally pure tones due to the deformed waveshape. In addition, a very annoying form of distortion may be produced when pulse type waveforms cause speaker or cabinet resonances to ring at a frequency several cycles removed from the repetition rate of the pulses, the resultant low frequency beats usually being very disagreeable.

One current solution to speaker "boom" and "one-note bass" is the highly damped speaker. Unfortunately this frequently leads to no bass at all, inasmuch as the poor pulse response of the speaker is not supplemented by the pulse broadening and higher consequent efficiency, produced by resonance. A similar effect is produced by lowering the speaker resonance frequency as pulse response usually falls off above this point.

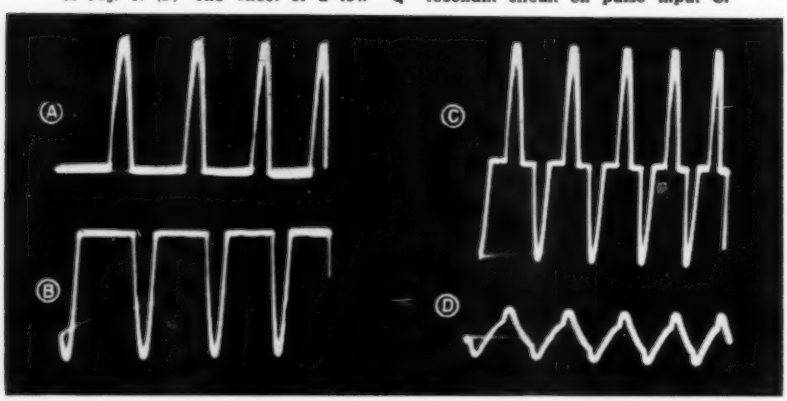
Fortunately it is not necessary to wait until speakers without mechanical inertia are perfected in order to achieve musical bass reproduction, as a number of corrective steps may be taken. Probably the first of these is to convert pulse-like waveforms into near-sine waveshapes which the loudspeaker can handle with much greater efficiency and less discrimination. The easiest way to do this is to place a recording microphone at the rear of the concert hall in order that the natural pulse broadening, produced by the acoustics, may be utilized. Pulse broadening may also be obtained by placing a number of microphones at varying distances from the musical source.

Lacking control over microphone placement, the average listener has two alternatives. The first and most flexible of these is pulse shaping in the electrical portions of his reproducing equipment with tone controls or equalizers of proper design. The second method, which has been receiving considerable attention in the last year or two, is pulse shaping through the use of specially designed speaker baffles or acoustic arrangements.

Pulse control in an audio amplifier is a convenient and flexible way of compensating for loudspeaker characteristics or even deficiencies in the initial recording. For example, the resonant characteristics of a sixteen-foot organ pipe may be much more easily simulated through use of simple electrical resonant circuits than through carpentry, and accordingly, changes in characteristics are much easier to make. The simplest type of pulse broadening is probably the low-"*Q*" resonant circuit and good pulse broadening over a limited range may be obtained without objectionable "ringing" if the "*Q*" of the circuit is held to about two. Although almost all resonant tone control circuits use only one *LC* combination in a given frequency range, an improvement in performance may be achieved by using two or more resonant circuits fairly closely spaced in a particular range. This allows pulse broadening to be effective over a wider range and also permits the use of higher "*Q*" circuits due to the fact that ringing will occur over a much wider range and the limited frequency bands are not unduly accentuated. This seems to be especially true if the resonant circuits are coupled to each other in such a way that an exchange of energy takes place. A circuit of this type is shown in Fig. 3.

A non-resonant form of pulse stretching may be obtained through use of simple resistance-capacitance delay networks of different electrical lengths (Fig. 4). A number of variations are illustrated in Fig. 5. The

Fig. 6. (A, B, and C) Pulse waveforms obtainable from the pulse forming circuit of Fig. 8. (D) The effect of a low "Q" resonant circuit on pulse input C.



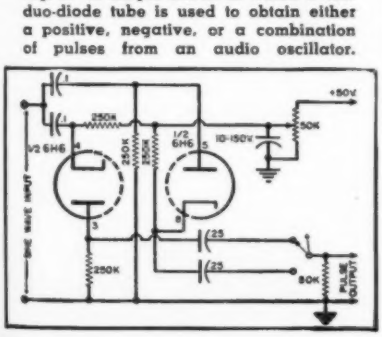
pulse characteristics obtainable by this method are very desirable and can actually represent an improvement over what the listener would hear if he were present at the original performance. The reason for this is that a fairly close microphone pickup may be made which captures a maximum of detail and the missing bass resulting from such a practice may then be supplied by the pulse stretcher, which seems to produce a somewhat smoother sound than does acoustic pulse broadening.

Pulse control after the loudspeaker may be secured by special baffle design. Probably the most common, and misused, example of this is the bass reflex cabinet. In this case there is usually a short delay path between the back of the speaker and the radiation from the front which introduces modifications in pulse shape as well as the static frequency characteristics. Some baffles, such as some of the corner horn designs, make use of back radiation (Fig. 7) from the speaker over a delay path. Other speaker baffles influencing pulse characteristics are the resonant column, the multiple resonant column, and the resonant box. In addition, notable improvement in apparent bass response may often be achieved through use of wall reflections in a large room, although in such a case the bass may seem to disappear as the listener approaches the speaker system.

No matter what type of system is used, the various low frequency resonances should be properly spaced for best listening results and reenforcing resonances should be kept to a minimum. For example, some phonograph pickup arms will resonate at about the same frequency as some of the larger diameter loudspeakers, and the resulting wide variation in sound pressure should be avoided. One method that the author used with success in the case of loudspeakers with fairly high resonant frequencies was to use an *LC* circuit in the amplifier, tuned about an octave lower. The resultant simplification of low frequency waveform greatly improves the smoothness of the bass response and, in several instances, provided very good reproduction of organ pedal notes from small groups of six-inch speakers in simple baffles.

(*Continued on page* 64)

Fig. 8. A simple circuit in which a 6H6 duo-diode tube is used to obtain either a positive, negative, or a combination of pulses from an audio oscillator.



Mac's RADIO SERVICE SHOP

By JOHN T. FRYE

"OPEN WIRE LINES"

THE sticky, sultry heat took away a person's appetite, and Barney used only a few minutes of his lunch hour to down a sandwich, a frosted malt, and a double-decker ice cream cone; then he fortified himself with a giant lemon *Coke* "for the road" and went back to the service shop. The inside of the shop felt cool and comfortable after the glaring heat outside, he thought to himself, as he passed through the empty front of the store to the service department at the rear.

Mac, his boss, looked up from where he squatted tailor-fashion on the service bench in the direct path of a humming electric fan that rustled the litter of papers, letters, magazines, and books about him. A slide rule was balanced on one knee, and he was chewing reflectively on a stub of pencil.

"Well, this is a switch: getting back early!" he remarked to his red-headed assistant. "You sick or something?"

"No," Barney replied as he collapsed on the other end of the bench. "I just love my work. What are you doing? Trying to dope out who the president is going to be?"

"Not exactly. I'm boning up on open wire transmission lines."

"Why the sudden interest in that?"

"For one thing, you may have noticed that they are becoming increasingly popular; but more important than that is my guess that they will get a lot more usage when u.h.f. TV stations really get going."

"Why, Daddy?" Barney asked in a rasping falsetto.

"Because the losses of ordinary flat twin-lead go up rapidly as the frequency increases. For example, at 500 megacycles, the dry-line loss is 3.2 db per hundred feet, and the wet-line loss zooms up to 20 db per hundred feet. Opposed to this is an open wire transmission line loss of only .78 db when dry and not much greater than this when wet."

"How about tubular twin-lead?"

"There is not too much difference in the dry-line loss, but the wet-line loss of tubular twin-lead is only 6.8 db per hundred feet at 500 megacycles. Even so, that is about eight times the loss of open wire line."

"Where are you getting all this information?"

"From a lot of sources: The good old *'The Radio Amateur's Handbook'* has a lot of good stuff on open wire lines; so does *Terman* in his *'Radio Engineering.'* I also went back through our magazine files and dug out all the articles on transmission lines that were published in the past ten years. Still, though, there were a lot of practical points I wanted to know about actually using the lines, and I decided the best place to go for the answers was to the men who built them. *Gonset* was the originator of the 450-ohm open wire line for TV use; so I wrote to them and got a fine letter back from W. W. Smith, chief engineer of the company. *Radio Merchandise Sales,* usually called *'RMS,'* is another big outfit that makes this line and several accessories for it; so I also wrote to them and received a prompt and detailed answer from their chief engineer, Martin Bettan. Thanks to the courtesy and help of these men and also to the books and magazine articles I have been reading, I am full up to here on open wire transmission lines. Just try and stump me!"

(*Continued on page* 122)

A No-Cost Signal Generator

By
PHILIP SCHLOSSBERG, USN (Ret.)
and
LOUIS BERKOWITZ
Head, Radio Department
Mass. Trades Shops Schools

How a midget superhet can be converted into a signal generator covering from 1006-2056 kc.

IF YOU are in need of a signal generator and are short of funds try one of these; one, called the "low cost" signal generator, gives good results for less than a dollar. Another, called the "ultra low cost" signal generator, gives good results for only a few pennies. There are many experimenters, amateurs, hobbyists, and part-time technicians who have need for a signal generator but feel that the expense involved would not warrant their investing thirty dollars or more in an instrument for which they have such limited use.

This article will show you how to construct a good, practical signal generator having a variable radio frequency range of from 1006 kc. to 2056 kc., also 456 kc.; all frequencies modulated by a 400-cycle audio tone.

This frequency range is practical for aligning the intermediate frequency amplifiers of most broadcast superheterodynes; and for aligning the radio frequency stage of the receiver at 1400 kc. or 1600 kc. Short-wave alignment frequencies may also be obtained by using harmonics of the fundamental generator frequencies.

Many servicing and testing operations can be performed with this "no cost" signal generator, such as alignment, signal injection, troubleshooting, approximate stage gain measurement, and locating dead stages in a receiver.

The amazingly low cost or no cost of this utility signal generator requires only that you have available an a.c.-d.c. midget superheterodyne receiver.

The construction of this signal generator is simplicity itself. It involves

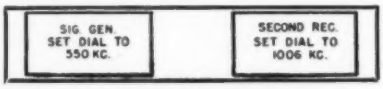


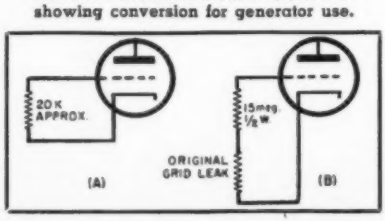
Fig. 1. Receiver used as a signal generator.

the conversion of the oscillator section of the radio which is to be used as the signal generator. The oscillator section of a superheterodyne usually consists of a Hartley type circuit with a low value grid leak, approximately 20,000 ohms for self bias. By increasing the grid leak resistance, self-modulation of the oscillator is made to take place at an audible rate. Fig. 2A shows the original grid leak circuit of the oscillator section.

In order to convert the circuit, all that is necessary is to unsolder the grid leak resistor from the tube socket, at the cathode end of the grid leak, and place a 15 megohm, one-half watt resistor in series with the original grid leak as shown in Fig. 2B.

15 megohms should give approximately a 400-cycle note; however, if a higher or a lower pitched audio frequency is desired the added grid leak

Fig. 2. (A) Original grid leak circuit of receiver's oscillator section. (B) Circuit showing conversion for generator use.



ohmic value may be changed to a lower or higher value. If the experimenter desires to build this signal generator at actually no cost he should follow this procedure: Take two ordinary paper clips and solder a five inch piece of hook-up wire to each clip; now take an ordinary business card and cut a strip two inches long by one-half inch wide; then draw several continuous black pencil lines on the card; next fasten the paper clips to the card to make contact with the pencil marks. This card is now a variable resistor of several megohms. Solder the ends of the hook-up wire into the oscillator grid circuit as shown in Fig. 2B. Turn on your signal generator and then vary the resistance of the card by sliding the paper clips back and forth until a pleasing audio tone is heard in another receiver which you must have to pick up the signal generator frequency (see Fig. 1).

Test the operation of the signal generator by slowly turning the generator dial from 550 kc. to about 1200 kc., while at the same time following the signal on the dial of the second radio from about 1010 kc. to 1600 kc.

To use the signal generator the following procedure is suggested.

For radio frequency. Turn on the signal generator; determine the frequency you desire, then subtract 456; next set the dial of the signal generator to that number.

For obtaining a 456 kc. signal. Connect a test lead through a 0.1 μfd. blocking condenser to the signal generator at its second detector diode plate and, if necessary, another connection between the signal generator chassis and the chassis of the radio being tested, using a 0.01 μfd. blocking condenser. Any dial setting of the signal generator will give 456 kc. with this connection, assuming that a station is being received on the signal generator.

For audio frequency. Connect across the voice coil of the signal generator loudspeaker. This gives you a strong audio signal of approximately 400 cycles. The strength of the audio signal can be controlled with the regular volume control on the signal generator.

For radio frequencies. The signal radiated is quite strong and needs no direct connection to the radio being tested. If a stronger signal is desired, wind three turns of any small size wire on the oscillator coil form of the signal generator and bring a test lead from these three turns to the circuit being tested.

Other uses for these practical little devices will suggest themselves as the experimenter discovers for himself that these so-called gadgets actually give excellent results and, while no claim is made that they are "just as good" as their more expensive "big brother" signal generators, they are most certainly worth a try—and use—until such time as you can better afford the cash expenditure for the more conventional type of signal generator.

—30—

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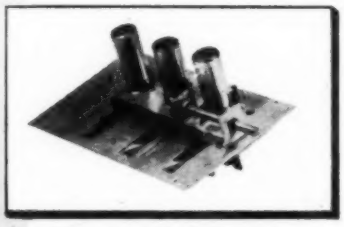

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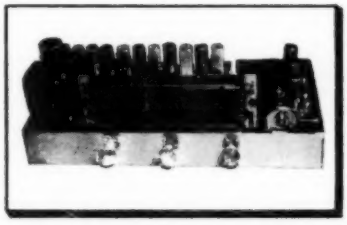

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Sound Reproduction

(*Continued from page* 61)

Although considerable space might be devoted to the effects of various pieces of equipment and circuit arrangements on pulse reproduction, it seems desirable to describe a simple pulse generator which may be used with an oscilloscope to make tests on the specific equipment in which the reader is interested. A diagram of such a generator is given in Fig. 8. It is used in conjunction with a conventional audio oscillator. Essentially, a 6H6 diode is biased in such a manner that only the sine-wave peaks are conducted through the tube. Either positive or negative peaks or a combination of both may be obtained in this way (Fig. 6) and the effective pulse width may be easily altered by varying the bias applied to the rectifier tube. A system of this nature has the advantage that the pulse repetition rate is easily determined from the setting of the audio oscillator and can be made to have a pulse shape of constant characteristics over a wide range of frequencies.

In making tests of pulse response, both relative amplitude of the pulses with respect to sine waves and pulse deformation should be checked. The pulse-type waveform may also be used as a sensitive method for detecting ringing resonances in loudspeakers or other devices as the pulse will tend to be smoothed out to a near sine wave when the repetition rate is the same as that of the ringing or some fraction such as one-half or one-third.

All tone controls investigated by the pulse method showed some alteration of the pulse shape, and the complaint that the use of tone controls sometimes lead to highly audible distortion was traced to this factor. Specifically, the worst trouble seemed to occur when a signal with appreciable asymmetry was fed into a bass boost circuit of the *RC* type and synthetic subsonic components were "detected" by the bass boost circuit due to the long time constant of the *RC* network. Most frequent cases of this kind are noted with some soprano voices, but second harmonic distortion preceding the tone control may cause this effect on other program material. Sometimes resistance-coupled amplifier stages may give similar trouble which is not easily noticed with sine- or square-wave tests, but may be more readily detected through use of asymmetrical pulses. In particular, the equipment should be checked to see that it will pass pulses with the same maximum amplitude as sine waves. Listening tests with a properly designed resonant bass boost circuit indicated appreciably cleaner reproduction than with a conventional *RC* network. This was attributed to the fact that the resonant circuit did not give an exaggerated saw-tooth effect to irrelevant noise pulses, which tends to greatly increase the low-frequency noise level and consequent masking of musical sounds. The resonant circuit likewise has the advantage of producing a more symmetrical pulse shape, and of providing a fairly sharp low-frequency cut-off which prevents generation of unwanted d.c. components.

In conclusion, it seems very likely that problems of pulse reproduction are of considerable importance in high quality sound, particularly where a firm musical bass is desired. Likewise it appears necessary to reproduce pulses in their proper amplitude and width in order to provide proper auditory "masking" of noise components, otherwise unnatural harshness may result or, in the case of some tape recorders, excessive modulation noise may be detected. Pulse control offers a definitely useful tool for the audio engineer, listener, or musician. —30—

Signal Level

(*Continued from page* 55)

phia) portion of Fig. 3 shows the 50 microvolt contours for a dipole, a standard conical-reflector, and a Channel 10 yagi. Notice how the 50 microvolt contour can be extended further and further from the station with antenna gain.

A number of important facts are revealed by the signal decline charts and range maps.

The rate of signal decline is much faster than the practical rate at which gain can be added to an antenna system. For example, using the Channel 3 signal decline curve we note that the 1000 microvolt contour is at 31½ miles. Just 26 miles beyond this, or at a range of 57 miles, an antenna with a phenomenal gain of 20 db would be needed to bring the signal up to the 1000 microvolt level. The signal decline averages one decibel per mile over most of the range.

We cannot expect too much from antenna systems in fringe reception. For example, let us assume we have a good quality receiver that does not show any effect for a 500 microvolt signal. Now, at a range of 70 miles (Channel 3) we have a signal of approximately 45 microvolts. This level produces a useful signal but one with high snow content. Suppose, in our enthusiasm, we decide to double the antenna height (up to 60 feet) and use a high-gain yagi (12 db). This more elaborate installation raises our signal by perhaps 15 db (assuming a conservative 3 db line, installation, and mismatch losses). This brings the signal level up to approximately 350 microvolts which is a decided improvement but still not high enough to take the snow effect out of the picture. This example also indicates why you should not expect too much from the increasing antenna height—it is quite a jump from a 30 footer to a 60 footer. The improvement is there and is worthwhile but don't expect miracles. —30—

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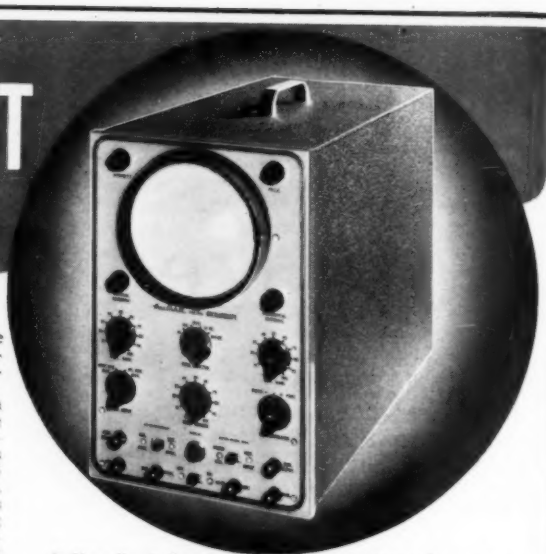

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Ideal for TV servicing — steep wavefronts encountered in TV work are easily handled. Fine for production line testing — rugged quality components can stand up under continuous hour-after-hour use. Excellent for laboratories — electrical performance comparable to scopes costing 4 and 5 times as much.

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- **New mounting of phase splitter and deflection amplifier tubes near CR tube base.**
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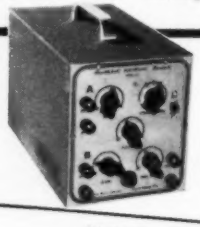
- **Tremendous sensitivity .03V RMS per inch Vertical — .6V RMS per inch Horizontal.**

MODEL S-2



Heathkit ELECTRONIC SWITCH KIT

SHIPPING WT. 11 LBS.

$19.50

The companion piece to a scope — Feed two different signals into the switch, connect its output to a scope, and you can observe both signals — each as an individual trace. Gain of each input is easily set (gain A and gain B controls), the switching frequency is simple to adjust (coarse and fine frequency controls), and the traces can be superimposed for comparison or separated for individual study (position contol).

The kit is complete with tubes, switches, cabinet, power transformer and all other parts, plus a clear detailed construction manual.

NEW Heathkit AUDIO FREQUENCY METER KIT

MODEL AF-1
SHIPPING WT. 15 LBS.

$34.50

The ideal instrument for determining frequencies from 20 cycles to 100 KC. Set the selector switch to the proper range — feed the signal into the input terminals — and read the frequency from the meter — completely simple to operate, and yet dependable results.

Quality Simpson 200 microampere meter has two plainly marked scales (0-100 0-300). These scales read in conjunction with the seven position selector switch, give full scale readings of 100, 300, 1000, 3000, 10,000, 30,000, and 100,000 cycles. Convenient ranges for fast and easy readings.

For greatest accuracy, the 1-3-10 ratio of ranges is maintained and each range has an individual calibrating control.

A signal voltage anywhere between 2 and 300V can be fed directly into the instrument and a change in signal voltage between these limits will not affect the meter reading. In addition, input wave shape is not critical (the unit will read the frequency of either sine wave or square wave input).

The tube complement consists of a 6SJ7 amplifier and clipper, 6V6 amplifier and clipper, 6H6 meter pulse rectifier, 6X5 power supply rectifier, and OD3/VR150 voltage regulator.

Construction is simple, and quality components are used throughout.

Heathkit INTERMODULATION ANALYZER KIT

MODEL IM-1
SHIPPING WT. 18 LBS.

$39.50

Intermodulation testing of audio equipment is rapidly being accepted by more and more engineers and audio experts as the best way to determine the characteristics of audio amplifiers, recording systems, networks, etc.

The Heathkit Intermodulation Analyzer supplies a choice of two high frequencies (approx. 3000 cycles and 7000 cycles) and one low frequency (60 cycles). Both 1:1 or 4:1 ratios of low to high frequencies can be set up for IM testing, and the ratios are easily set by means of a panel control and the instrument's own VTVM. An output level control supplies the mixed signal at the desired level with an output impedance of two thousand ohms. The Analyzer section has input level control and proper filter circuits feeding the instrument's VTVM to read intermodulation directly on full scale ranges of 30%, 10% and 3%. Built-in power supply furnishes all necessary voltages for operating the instrument.

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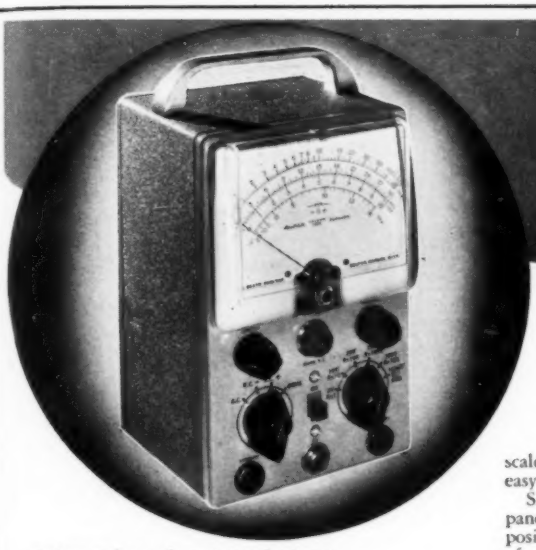
THE *New* 1952 *Heathkit*
VTVM KIT



MODEL V5-A
SHIPPING WT. 7 LBS.

$24.50

- New styling, — formed case for beauty.
- New truly compact size. Cabinet 4⅛" deep by 4-11/16" wide by 7-3/8" high.
- Quality 200 microamp meter.
- New ohms battery holding clamp and spring clip — assurance of good electrical contact.
- Highest quality precision resistors in multiplier circuit.
- Calibrates on both AC and DC for maximum accuracy.
- Terrific coverage — reads from ½V to 1000V AC, ½V to 1000V DC, and .1 to over 1 billion ohms resistance.
- Large, clearly marked meter scales indicate ohms, AC Volts, DC Volts, and DB — has zero set mark for FM alignment.

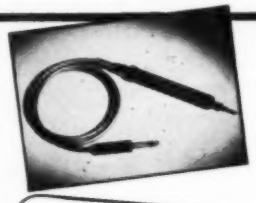
Designed to take up a minimum of space, yet designed to be the most important and useful instrument on your workbench. Really handsome looking — note the rounded edges on front panel and rear cover. New compact size has cabinet dimensions of only 4⅛" deep x 4 11/16" wide x 7⅜" high.

Tremendous coverage — will read from ½V to 1000V AC, ½V to 1000V DC, .1 to over 1 billion ohms resistance, and Db. Meter scale has zero-set mark for FM alignment — all scales clearly marked for easy and fast readings and Db scale is in red for easy identification.

Simple to operate. Ohms adjust and zero adjust controls located on front panel along with selector and range switches. Selector switch has four positions: AC. DC−, DC+ and Ohms to set up the instrument for type of reading desired. DC− position allows negative voltages to be taken without reversing test prods. AC and DC voltage ranges are full scale 3V — 10V — 30V — 100V — 300V — 1000V and resistance ranges are RX1, X10, X100, X1000, X10M, X1 Megohm. Convenient ranges for fast and accurate readings.

Strictly highest quality components used throughout — 1% precision resistors in multiplier circuit, Simpson 200 microampere meter movement, sturdy cabinet, excellent positive detent smooth acting switches, etc. New miniature tube used in meter balancing circuit and new battery holding clamp and spring clip assure good contact to ohms string of resistors.

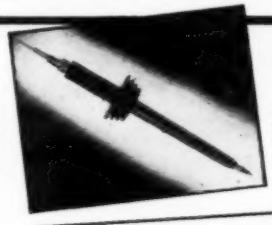
Kit comes complete — and the instruction manual with its step-by-step instructions, pictorials, figures, and schematic makes assembly a pleasure.



Heathkit R F PROBE KIT

Extends range of Heathkit VTVM to 250 MC ± 10%. Designed for taking RF measurements. All parts furnished including probe housing and crystal diode detector. Shipping Weight 1 lb.

$5.50



Heathkit 30,000 V DC PROBE KIT

For taking readings up to 30,000 V DC when used with the Heathkit VTVM (or any standard 11 megohm VTVM). Comes with two color molded plastic probe body and all parts. Shipping Wt. 2 lbs.

$5.50

Heathkit A. C. VACUUM TUBE VOLTMETER KIT

Now — as a Heathkit — at a price anyone can afford, an AC VTVM. Makes possible those sensitive AC measurements required by audio enthusiasts, laboratories, and experimentors. The kit audio men have been looking for. Ten ranges consisting of full scale .01, .03, .1, .3, 1, 3, 10, 30, 100, 300 volts RMS assure easy and more accurate readings. Ten ranges on DB provide for, measurements from −52 to +52 DB. Frequency response within 1 DB from 20 cycles to 50 KC.

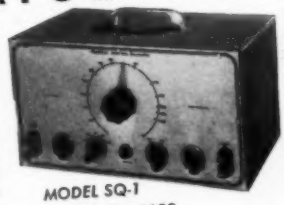
The ingenious circuitry incorporates precision multiplied resistors for accuracy, two amplifier stages using miniature tubes, a unique bridge rectifier meter circuit, quality Simpson meter with 200 microampere movement, and a clean layout of parts for easy wiring. A high degree of inverse feedback provides for stability and linearity.

Extremely compact, cabinet size — 4-1/8" deep x 4-11/-16" wide x 7-3/8" high. Newly designed cabinet makes this the companion piece to the VTVM.

MODEL AV-1
SHIP. WT. 5 LBS.

$29.50

Heathkit SQUARE WAVE GENERATOR KIT



The Heathkit Square Wave Generator is an excellent square wave frequency source with features you won't want to be without. Especially notable is the wide range of the instrument — 10 cycles to 100 kilocycles continuously variable. This wide range makes it useful for television and wide band amplifier work as well as audio experimentation. The output impedance is low, and the output voltage is continuously variable between 0 and 20 volts. Because a multivibrator stage cannot be accurately calibrated, terminals on the front panel can be used for synchronization to an external source should it be desired.

MODEL SQ-1
SHIP. WT. 14 LBS.

$29.50

The circuitry consists of a multivibrator stage, a clipping and a squaring stage, and a cathode follower output stage. The power supply is transformer operated and utilizes a full wave rectifier tube with 2 sections of LC filtering.

For a good, wide range, and low priced square wave generator, the SQ-1 just can't be beat.

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Heathkit

SIGNAL GENERATOR KIT

Model SG-6
Shipping Wt. 7 lbs.

$19.50

The new Heathkit Signal Generator Kit has dozens of improvements. Covers the extended range of 160 Kc to 50 megacycles on fundamentals and up to 150 megacycles on useful calibrated harmonics; makes this Heathkit ideal as a marker oscillator for TV. Output level can be conveniently set by means of both step attenuator and continuously variable output controls. Instrument has new miniature HF tubes to easily handle the high frequencies covered.

Uses 6C4 master oscillator and 6C4 sine wave audio oscillator. The kit is transformer operated and a husky selenium rectifier is used in the power supply. All coils are precision wound and checked for calibration making only one adjustment necessary for all bands.

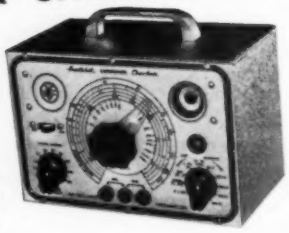
New sine wave audio oscillator provides internal modulation and is also available for external audio testing. Switch provided allows the oscillator to be modulated by an external audio oscillator for fidelity testing of receivers. Comes complete, all tubes, cabinet, test leads, every part. The instruction manual has step-by-step instructions and pictorials. It's easy and fun to build a Heathkit Model SG-6 Signal Generator.

Heathkit

CONDENSER CHECKER KIT

Only

$19.50



Model C-2
Shipping Wt. 6 lbs.

Checks all types of condensers — paper — mica — ceramic — electrolytic. All condenser scales are direct reading and require no charts or multipliers. Covers range of .00001 MFD to 1000 MFD. A Condenser Checker that anyone can read. A leakage test and polarizing voltage for 20 to 500 V provided. Measures power factor of electrolytics between 0% and 50% and reads resistance from 100 ohms to 5 megohms. The magic eye indicator makes testing easy.

The kit is 110V 60 cycle transformer operated and comes complete with rectifier tube, magic eye tube, cabinet, calibrated panel and all other parts. Has clear detailed instructions for assembly and use.

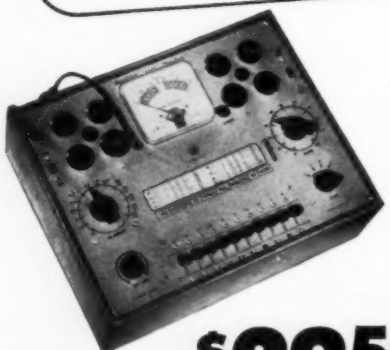
NEW *Heathkit*

SIGNAL TRACER AND UNIVERSAL TEST SPEAKER KIT

$19.50

Model T-2
Shipping Wt. 7 lbs.

The popular Heathkit Signal Tracer has now been combined with a universal test speaker at no increase in price. The same high quality tracer follows signal from antenna to speaker — locates intermittents — finds defective parts quicker — saves valuable service time — gives greater income per service hour. Works equally well on broadcast, FM, or TV receivers. The test speaker has an assortment of switching ranges to match either push-pull or single output impedances. Also tests microphones, pickups and PA systems. Comes complete: cabinet, 110V 60 cycle power transformer, tubes, test probe, all necessary parts, and detailed instructions for assembly and use.



Model TC-1
Shipping Wt. 12 lbs.

$29.50

Heathkit

TUBE CHECKER KIT

The Tube Checker is a MUST for radio repair men. Often customers want to SEE tubes checked, and a checker like this builds customer confidence. In your repairing, you will have a multitude of tubes to check — quickly. The Heathkit tube checker will serve all these functions — it's good looking (with a polished birch cabinet and an attractive two color panel) — checks 4, 5, 6, 7 prong Octals, Loctals, 7 prong miniatures, 9 prong miniatures, pilot lights, and the Hytron 5 prong types. AND IT'S FAST TO OPERATE — the gear driven, free-running roll chart lists hundreds of tubes, and the smooth acting, simplified switching arrangement gives really rapid set-ups.

The testing arrangement is designed so that you will be able to test new tubes of the future — without even waiting for factory data — protection against obsolescence.

You can give tubes a thorough testing — checks for opens, shorts, each element individually, emission, and for filament continuity. A large BAD-?-GOOD meter scale is in three colors for easy reading and also has a "line-set" mark.

You'll find this tube checker kit a good investment — and it's only $29.50.

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The **HEATH COMPANY**

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NEW 1952 *Heathkit*

BATTERY ELIMINATOR KIT

Model BE-3
Shipping Wt. 17 lbs.

- **Can be used as battery charger.**
- **Continuously variable output 0 - 8 Volts — not switch type.**
- **Heavy duty Mallory 17 disk type magnesium copper sulfide rectifier.**
- **Automatic overload relay for maximum protection. Self-resetting type.**
- **Ideal for battery, aircraft and marine radios.**
- **Dual Volt and Ammeters read both voltage and amperage continually — no switching.**

The new Heathkit Model BE-3 incorporates the best. Continuously variable output control is of the variable transformer type with smooth wiper type contacts.

There are no switches or steps and voltage between 0 and 8 Volts is available at 10 Amperes continuous and 15 Amperes intermittent. Maximum safety from overloads and shorts provided by automatic overload relay which resets itself when overload is removed.

The new rectifier is a 17 plate Mallory magnesium copper sulfide type. This is the most rugged type available for long trouble-free use.

Output is continuously metered by both a 0 - 10 Volt Voltmeter and a 0 - 15 Amp Ammeter. Shorted vibrators indicated instantly by ammeter.

Equip now for all types of service — aircraft — marine — auto and battery radios — this inexpensive instrument vastly increases service possibilities — better be ready when the customer walks in.

NEW *Heathkit*
SINE AND SQUARE WAVE

AUDIO GENERATOR KIT

Designed with versatility, usefulness, and dependability in mind, the AG-7 gives you the two most needed wave shapes right at your fingertips — the sine wave and the square wave.

The range switch and plainly calibrated frequency scale give rapid and easy frequency selection, and the output control permits setting the output to any desired level.

A high-low impedance switch sets the instrument for either high or low impedance output —on high to connect a high impedance load, and on low to work into a low impedance transformer with negligible DC resistance.

Coverage is from 20 to 20,000 cycles, and distortion is at a minimum — you can really trust the output wave shape.

Six tubes, quality 4 gang tuning condenser, power transformer, metal cased filter condenser, 1% precision resistors in the frequency determining circuit, and all other parts come with the kit —plus, a complete construction manual — A tremendous kit, and the price is truly low.

Model AG-7
Shipping Wt. 15 lbs.

$34.50

THE NEW *Heathkit*

HANDITESTER KIT

A precision portable volt-ohm milliammeter. Uses only high quality parts — All precision 1% resistors, three deck switch for trouble-free mounting of parts, specially designed battery mounting bracket, smooth acting ohm adjust control, beautiful molded bakelite case, 400 micro-amp meter movement, etc.

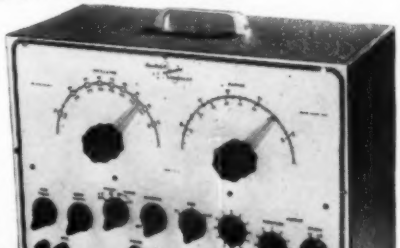
DC and AC voltage ranges 10 - 30 - 300 - 1000 - 5000V. Ohms range 0 - 3000 and 0 - 300,000. Range Milliamperes 0 - 10 Ma, 0 - 100 Ma. Easily assembled from complete instructions and pictorial diagrams.

$13.50

Model M-1
Shipping Wt. 3 lbs.

NEW *Heathkit*

T.V. ALIGNMENT GENERATOR KIT



Here is an excellent TV Alignment Generator designed to do TV service work quickly, easily, and properly. The Model TS-2 when used in conjunction with an oscilloscope provides a means of correctly aligning television receivers.

The instrument provides a frequency modulated signal covering, in two bands, the range of 10 to 90 Mc. and 150 to 230 Mc.— ALL ALLOCATED TV CHANNELS AS WELL AS IF FREQUENCIES ARE COVERED.

An absorption type frequency marker covers from 20 to 75 Mc. in two ranges—therefore, you have a simple, convenient means of frequency checking of IF's, independent of oscillator calibration.

Sweep width is controlled from the front panel and covers a sweep deviation of 0-12 Mc.—all the sweep you could possibly need or want.

And still other excellent features are: Horizontal sweep voltage available at the front panel (and controlled with a phasing control—both step and continuously variable attenuation for setting the output signal to the desired level—a convenient instrument stand-by position—vernier drive of both oscillator and marker tuning condensers—and blanking for establishing a single trace with base reference level. Make your work easier, save time, and repair with confidence—order your Heathkit TV Alignment Generator now!

Model TS-2
Shipping Wt. 20 lbs.

$39.50

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Heathkit IMPEDANCE BRIDGE KIT

Model 1B-1B
Shipping Wt. 15 lbs.

$69.50

This Impedance Bridge Kit is really a favorite with schools, industrial laboratories, and serious experimenters. An invaluable instrument for those doing electrical measurements work. Reads resistance from .01 Ohms to 10 meg., capacitance from .00001 to 100 MFD, inductance from 10 microhenries to 100 henries, dissipation factor from .002 to 1, and storage factor from 1 to 1000. And you don't have to worry about selecting the proper bridge circuit for the various measurements — the instrument automatically makes the correct circuit when you set up for taking the measurement you want. Bridge utilizes Wheatstone, Hay, Maxwell, and capacitance comparison circuits for the wide range and types of measurements possible. And it's self powered — has internal battery and 1000 cycle hummer. No external generator required — has provisions for external generator if measurements at other than 1000 cycles are desired. Kit utilizes only highest quality parts, General Radio main calibrated control. Mallory ceramic switches, excellent 200 microamp zero center galvanometer, laboratory type binding posts with standard ¾ inch centers, 1% precision ceramic-body type multiplier resistors, beautiful birch cabinet and ready calibrated panel. (Headphones not included.)

Take the guesswork out of electrical measurements — order your Heathkit Impedance Bridge kit today — you'll like it.

Heathkit LABORATORY RESISTANCE DECADE KIT

$19.50
Shipping Wt. 4 lbs.

An indispensable piece of laboratory equipment — the Heathkit Resistance Decade Kit gives you resistance settings from 1 to 99,999 ohms IN ONE OHM STEPS. For greatest accuracy, 1% precision ceramic-body type resistors and highest quality ceramic wafer switches are used.

Designed to match the Impedance Bridge above, the Resistance Decade Kit has a beautiful birch cabinet and attractive panel. It's easy to build, and comes complete with all parts and construction manual.

Heathkit LABORATORY POWER SUPPLY KITS

Limits:

No load	Variable	150-400V DC
25 MA	Variable	30-310V DC
50 MA	Variable	25-250V DC

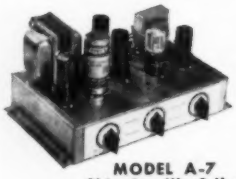
Higher loads: Voltage drops off proportionally

$29.50
Model PS-1.....Ship. Wt. 20 lbs.

Every experimenter needs a good power supply for electronic setups of all kinds. This unit has been expressly designed to act as a HV supply and a 6.3 V filament voltage source. Voltage control allows selection of HV output desired (continuously variable within limits outlined), and a Volts-Ma switch provides choice of output metering. A large plainly marked and direct reading meter scale indicates either DC voltage output in Volts or DC current output in Ma. (Range of meter 0-500V D.C., 0-200 Ma. D.C.). Instrument has convenient stand-by position and pilot light.

Comes with power transformer, filament transformer, meter, 5Y3 rectifier, two 1619 control tubes, completely punched and formed chassis, panel, cabinet, detailed construction manual, and all other parts to make the kit complete.

Heathkit ECONOMY . . . 6 WATT AMPLIFIER KIT



MODEL A-7
Shipping Wt. 8 lbs.

$14.50

- Choice of 4-8-15 ohm output impedances.
- Response flat ± 1½ db from 20—20,000 cycles.
- 6 watts output.
- Good fidelity at low cost.
- Output tubes working in push pull.
- Volume, bass, and treble controls.
- Two separate inputs.

The purpose of this kit is to provide to the kit builder a low cost amplifier with excellent fidelity. The circuit consists of four tubes with following functions: a 12SL7, one section working as an amplifier and one as a phase splitter, two 12A6 output tubes working in push pull, and a 5Y3 rectifier in a full wave rectifier circuit.

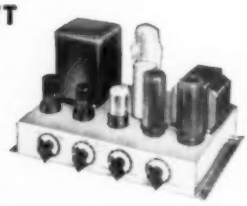
The unit operates from a husky power transformer, and has good output transformer with a choice of 4—8—15 ohm output impedances. (Speaker not included).

The kit provides excellent listening pleasure and the price is really low. Compare it with all others. You won't find a better buy.

MODEL A-7: For tuner and crystal phono inputs. Has two position selector switch for convenient switching to type of input desired.

Model A-7-A: Has a 12SH7 preamplifier stage with special compensation network for operation with reluctance phono input.
Shipping Wt. 8 lbs.....**$16.50**

Heathkit HIGH FIDELITY 20 WATT AMPLIFIER KIT



MODEL A-8
Shipping Wt. 18 lbs.

$33.50

The A8 (or A-8A) is a high quality amplifier for those who want high fidelity output at moderate cost. Frequency response within ± 1db from 20-20,000 cycles. Distortion at 3db below maximum power output (at 1,000 cycles) is only .8%. Kit has a Chicago power transformer in drawn steel case and a Peerless output transformer with output impedances of 4—8—16 ohms. Bass and treble controls permit listener to select output with tonal qualities of his own liking.

The tube lineup is composed of a 6SJ7 voltage amplifier, a 6SN7 amplifier and phase splitter, two 6L6's in push-pull output and a 5U4G rectifier. All parts furnished (speaker not included) and the construction manual makes assembly easy.

MODEL A-8: For tuner and crystal phono inputs. Has two position selector switch for convenient switching to type of input desired.

MODEL A-8A: Features an added 6SJ7 stage (preamplifier) for operating from variable reluctance cartridge phono pickup, mike input, and either tuner or standard crystal phono pickup. A three position selector switch provides flexible switching. Shipping Wt. 18 lbs.....**$35.50**

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Heathkit RECEIVER & TUNER KITS for AM and FM

$19.50

Model BR-1 Broadcast Model Kit covers 550 to 1600 Kc. Shipping Wt. 10 lbs.

Model AR-1 3 Band Receiver Kit covers 550 Kc. to over 20 Mc. continuous. Extremely high sensitivity. Shipping Wt. 10 lbs.

$23.50

TWO HIGH QUALITY Heathkit SUPERHETERODYNE RECEIVER KITS

Two excellent Heathkits. Ideal for schools, replacement of worn out receivers, amateur and custom installations.

Both are transformer operated quality units. The best of materials used throughout — six inch calibrated slide rule dial — quality power output transformers — dual iron core shielded. I.F. coils — metal cased filter condenser. The chassis has phono input jacks, 110 Volt output for phono motor and there is a phono-radio switch on panel. A large metal panel simplifying installation in used console cabinets is included. Comes complete with tubes and instruction manual incorporating pictorials and step-by-step instructions (less speaker and cabinet). The three band model has simple coil turret which is assembled separately for ease of construction.

Model FM-2
Ship. Wt. 9 lbs.

$22.50

TRUE FM FROM Heathkit FM TUNER KIT

The Heathkit FM Tuner Model FM-2 was designed for best tonal reproduction. The circuit incorporates the most desirable FM features — true FM.

Utilizes 8 tubes: 7E5 Oscillator, 6SH7 mixer, two 6SH7 IF amplifiers, 6SH7 limiter, two 7C4 diodes as discriminator, and 6X5 rectifier.

The instrument is transformer operated making it safe for connection to any type receiver or amplifier. Has ready wound and adjusted RF coils, and 2 stages of 10.7 Mc IF (including limiter). A calibrated six inch slide rule dial has vernier drive for easy tuning. All parts and complete construction manual furnished.

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	Heathkit Oscilloscope Kit — Model O-7			Heathkit H.V. Probe Kit — No. 336	
	Heathkit VTVM Kit — Model V-5-A			Heathkit R.F. Signal Gen. Kit — Model SG-6	
	Heathkit FM Tuner Kit — FM-2			Heathkit Condenser Checker Kit — Model C-2	
	Heathkit Broadcast Receiver Kit — Model BR-1			Heathkit Handitester Kit — Model M-1	
	Heathkit Three Band Receiver Kit—Model AR-1			Heathkit Power Supply Kit — Model PS-1	
	Heathkit Amplifier Kit —Model A-7 (or A-7-A)			Heathkit Resistance Decade Kit — Model RD-1	
	Heathkit Amplifier Kit — Model A-8 (or A-8A)			Heathkit Impedance Bridge Kit — Model IB-1B	
	Heathkit Tube Checker Kit — Model TC-1			Heathkit A.C. VTVM-KIT — Model AV-1	
	Heathkit Audio Generator Kit — Model AG-7			Heathkit Intermodul. Analyzer Kit—Model IM-1	
	Heathkit Battery Eliminator Kit — Model BE-3			Heathkit Audio Freq. Meter Kit — Model AF-1	
	Heathkit Electronic Switch Kit — Model S-2			Heathkit Square Wave Gen. Kit — Model SQ-1	
	Heathkit T.V. Alignment Gen. Kit — TS-2				
	Heathkit Signal Tracer Kit — Model T-2				
	Heathkit R.F. Probe Kit — No. 309				

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Spot Radio News

(*Continued from page* 16)

and boss, too, Wayne Coy, recently harshly criticized on the floor of the Senate by Senator Herman Welker, who said that Coy's resignation and employment within twenty-four hours as a radio-TV consultant at a substantial salary should be explained. Declaring that . . . "It seems in this case we have a man who is very well acquainted with the present members of the Commission," the Senator added that it might be said that the former headman was being retained . . . "not for his great television ability, but because of his former connection with the FCC."

The former FCC chieftain joined stations KOB-AM-TV in Albuquerque, New Mexico, shortly after he resigned from the Commission. KOB-AM-TV was sold to a national weekly publisher who, in turn, sold a fifty per-cent interest in the license to Coy for $75,000. Half of this sum was paid by the former headman out of personal funds and the remainder was guaranteed under a bank loan. When the transactions were completed, Coy was named general manager of these two Albuquerque stations at a salary of $26,000 on an eight-year contract. In addition, he will receive $24,000 as a radio-TV consultant to the publisher.

The Senator had told his colleagues that he wanted to know where Coy secured funds to buy the station. The application revealed the answer, disclosing in detail all of the assets of the former Commissioner, which more than covered the price that will be paid for the AM and TV facilities.

RADIO'S contributions to air navigation received quite a handsome tribute in the annual report of the Air Navigation Development Board. It was noted, for instance, that the provision of ground-based radar in terminal areas has made possible the greatest single improvement in traffic control in the last decade. Successive approach intervals of three minutes are now routine at those airports having radars and trained radar controllers, the report indicated.

The recent improvements in traffic control efficiency have come about, it was said, through the ability of radar to provide controllers with instantaneous, accurate, and unambiguous position data. It is expected that the next major step toward better traffic control will be in the introduction of simple airborne transponder beacons, which will provide longer distance radar coverage, freedom from ground echoes and simple aircraft identification.

Reviewing the possibilities of ground surveillance radar, supplemented by airborne transponders, used in conjunction with VOR and DME (v.h.f. omnirange and distance measuring equipment), the report declared that these facilities will be sufficient to handle traffic of mixed aircraft types at a rate of 30 operations per hour on a single runway, and single-type aircraft traffic at a rate of 45 per hour. For higher traffic rates, it was noted, the basic traffic control radar will have to be supplemented by somewhat more refined data reduction devices. These might take the form of radar automatic tracking circuits (which will also measure ground speed), filtered displays showing aircraft location and identity, and sequencing devices which automatically select the most efficient order of aircraft arrival at entry to final approach, and the most efficient intervals between successive aircraft.

There are 426 omnidirectional stations in the country and possessions planned with 305 now in operation. All operate on the very-highs. At each of these sites, according to the report, ultra-high distance measuring equipment will be installed soon. The coverage and accuracy of these systems have been studied carefully, and it has been found that except in the vicinity of unusual terrain conditions, aircraft position can be determined with a precision of two to three degrees in azimuth, and one half of one-per-cent of distance-to-station out to distances of 100 miles from the ground station. When the test aircraft was shielded from the station by mountains, considerable deterioration in accuracy, as well as signal attenuation was experienced. However, it was noted, these measured accuracies appear to be completely adequate for en route and terminal-area navigation for any traffic densities foreseen for the next ten years. In the long-term future, higher traffic densities may demand higher navigational accuracies. It was believed this type of precision control can be provided by the ultra-high distance measuring equipment without change, together with a very-high omnirange, with a modified transmitting antenna. The report revealed that development of such an antenna was under way, showing promise of increasing the omnirange accuracy to three-quarters of one degree. It was expected, from the standpoint of accuracy, that there will be no need for a replacement for the very-high/ultra-high combination, in the foreseeable future.

Describing the uses of ILS fixed-beam approach aids, particularly when monitored by precision approach radar (PAR), the ANDB review noted that these facilities have proved satisfactory down to operational minima of 200 feet ceiling and one-half mile visibility. Under worse weather, approach lights have been found necessary. It appears as if the limitation (which is shared by PAR) is due to the inability of the system to provide sufficiently accurate guidance with respect to a flared glide path, or a heading reference sufficient to allow killing drift just prior to touchdown. In addition, it was noted, ILS and PAR impose limitations on airport acceptance rate because of the relatively long straight

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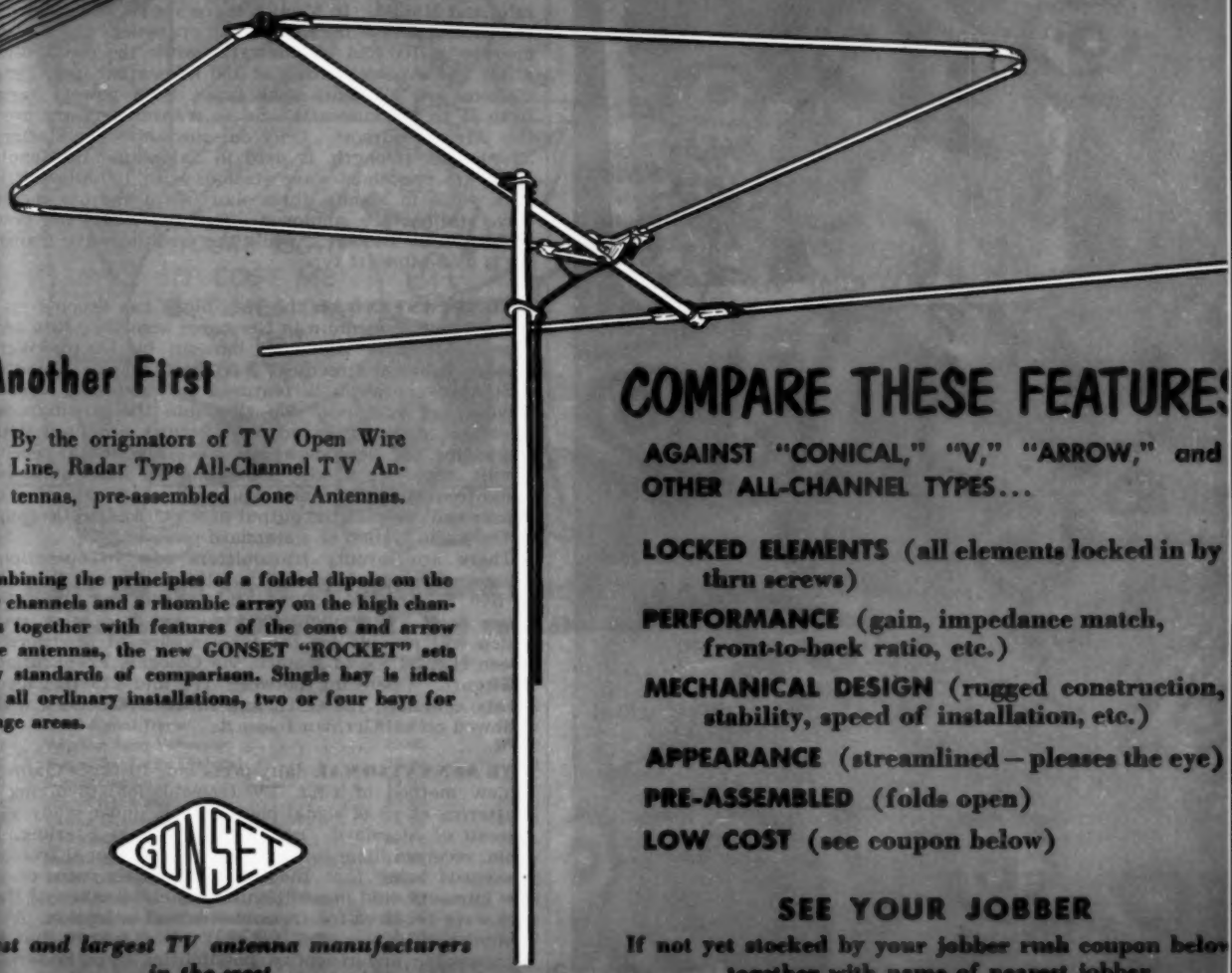

Another First

By the originators of TV Open Wire Line, Radar Type All-Channel TV Antennas, pre-assembled Cone Antennas.

Combining the principles of a folded dipole on the low channels and a rhombic array on the high channels together with features of the cone and arrow type antennas, the new GONSET "ROCKET" sets new standards of comparison. Single bay is ideal for all ordinary installations, two or four bays for fringe areas.

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Oldest and largest TV antenna manufacturers in the west

COMPARE THESE FEATURES

AGAINST "CONICAL," "V," "ARROW," and OTHER ALL-CHANNEL TYPES...

LOCKED ELEMENTS (all elements locked in by thru screws)

PERFORMANCE (gain, impedance match, front-to-back ratio, etc.)

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Please RUSH SAMPLE GONSET "ROCKET" on 2 week MONEY BACK basis.

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#1506 ☐	one GONSET "ROCKET" (less mast)	$ 6.45	$ 3.87
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approach path which must be flown by all aircraft. These limitations, the ANDB admitted, will make it necessary to replace ILS and PAR, at least at busy terminals, within the next decade.

THE VOICE OF AMERICA, which has become so vital a factor in our international program, has certainly spread its wings since the wintry days of '42 when the first broadcast, a German-language affair, was made from New York by trans-Atlantic telephone to London and then relayed to Germany over seven transmitters operated by the BBC. At the end of the war in Europe, Voice of America programs were being beamed to the Continent from twenty-six short-wave transmitters on the Atlantic seaboard and to the Far East from ten short-wave transmitters on the Pacific Coast. At that time, many of the programs were also being relayed from transmitters in London, Algiers, Luxembourg, Hawaii, Saipan, and the Philippines. Currently, there are thirty-eight short-wave transmitters in operation in this country, with power ratings of from 50 to 200 kilowatts.

The VOA broadcasts are also relayed and rebroadcast by a chain of relay bases in Munich, Tangier, Salonika, Honolulu, and Manila. In Munich there are six short-wave and one medium-wave transmitters in operation; the s.w. units operate on 100 and 7.5 kilowatts, while the medium-wave affair has a power rating of 150 kilowatts. The Tangier stations are all short-wave types, with powers ranging from 35 to 100 kilowatts. Seven transmitters are used in this African outpost. Only one medium-wave station, of 50-kilowatt strength, is used in Salonika. In Honolulu, there are two short-wave stations with 100-kilowatt outputs, while in Manila, three short-wave and one medium-wave stations are employed. The s.w. setups use powers of 7.5 and 50 kilowatts, while the medium-wave transmitter is a 50-kilowatt type.

BROADCASTING on the very-highs has become an extremely active medium in Germany, according to a report recently filed in the *EBU* bulletin by Doctor Werner Nestal, technical director of Nordwestdeutscher Rundfunk.

Superregeneration is featured in low-priced v.h.f. receivers and adapters. To eliminate the possibilities of interference, two-tube adapter circuits are used with a single-envelope pentode and triode. The actual receiving circuit employs a triode. Following the super stage is an audio-frequency filter and equalizer, consisting of a condenser and resistor, the output of which is directly coupled to the audio system of a standard receiver.

There are seventy transmitters now in operation in Western Germany. In addition, this autumn will see four to five TV stations on the air transmitting about three hours daily. Now under construction is a relay system which will provide for the transmission of programs between Hamburg and Munich, via Cologne, Frankfurt, and Stuttgart. Operating between 174 and 215 megacycles, on six channels, the CCIR standards of 625 lines will be followed on all German telecasts.

THE SENSATIONAL daily-press long-distance claims for a new method of v.h.f. TV transmission, involving the scattering effect of signal phenomenon, under study at the Bureau of Standards' receiving station at Sterling, Virginia, received little support on the professional front, the consensus being that the received signals were of very low intensity, and in addition extremely directional rhombics were required for transmission and reception. At the Commission, it was admitted that it was known that such transmission and reception possibilities were known, but its commercial applications to TV were small, since extremely high powers would be required to provide any kind of a consistent picture on a 6-megacycle band.

Both the Commission and the Bureau were flooded with calls when the newspaper stories appeared. Dealers were also swamped with inquiries and sales slumped sharply for several days, until it was revealed that the tests would not affect the allocation tables and TV would continue to be a Channel 2 to 83 operation for many, many years to come, notwithstanding the breathless predictions appearing in the columns of newspapers. . . . . L.W.

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625	Tube Tester	34.95	49.95
950	Resistance-Capacitance Bridge & R-C-L Comparator	19.95	29.95
1040	Battery Eliminator & Charger	25.95	34.95
1171	Resistance Decade Box	19.95	24.95
HVP-1	High Voltage Probe for Model 221		6.95
P75	R. F. Probe, crystal type, for any VTVM	3.75	5.95
P76	R. F. Probe, for any scope or VTVM	3.75	5.95
C5	Crystal (5MC)		3.95
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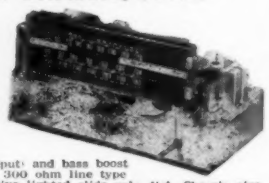
★ WIDE RANGE AUDIO
★ WHY NOT ORDER WITH A COAXIAL SPEAKER AND A RECORD CHANGER? SEE OUR SPECIAL OFFERING



McGee's new 1952 model 12-tube FM-AM chassis. Latest design with phono inputs for all types of record players, crystal or G.E. variable reluctance. Receives standard broadcast 550 to 1700 kc and FM 88 to 108 mc. Wide range audio response (push-pull 6V6 output) and bass boost tone control. Loop antenna for broadcast and 300 ohm line type FM antenna may be stapled in cabinet. Attractive lighted slide rule dial. Chassis size, 13¼" x 9" high and 9" deep. Complete with tubes: 6BE6, 6BA6, 6BA6, 12AT7, 6SH7, 6AL5, 6SQ7, 6SQ7, 12AT7, 2—6V6GT and 5Y3GT rectifier. Shipping weight 20 lbs. Stock No. 7C-X Espey 12-tube FM-AM chassis. Sale price, **$64.50**, less speaker. Output matches voice coil of our 12" or 15" coaxial speakers.

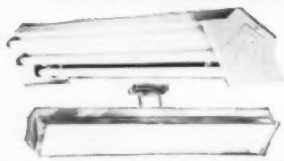
ESPEY DEAL (1), $104.95
Espey 7-C chassis complete with 12" coaxial PM speaker CU-14Y and VM-950 G.E. 3-speed changer equipped with a G.E. turnabout variable reluctance cartridge. A better home music system than ordinarily available. Espey Deal #1. Sale price **$104.95.** With 15" coaxial PM speaker P15-CR instead of CU-14Y, **$10.00** extra.

ESPEY DEAL (2), $118.95
Espey 7-C chassis complete with 12" coaxial PM speaker CU-14Y and the English Garrard 3-speed changer equipped with a G.E. variable reluctance turnabout cartridge. Our best home music system. Espey Deal #2. Sale price **$118.95.** With 15" coaxial PM speaker P15-CR instead of CU-14Y, **$10.00** extra.

ESPEY DEAL (3) $138.95
Espey 7-C chassis complete with THREE 12" coaxial PM speakers CU-14Y (these three 12" coaxial speakers give a cone area equal to an 18" speaker) and a Garrard 3-speed changer with G.E. variable reluctance turnabout cartridge. Espey Deal #3. Sale price **$138.95.**

TERRIFIC FLUORESCENT FIXTURE SALE

IS YOUR SERVICE DEPT. PROPERLY LIGHTED? SAVE 50% ON THIS 4-LIGHT FIXTURE
$12.95, TWO FOR $25.00 WITH LAMPS



TOP ILLUSTRATION—This is the finest value in a fluorescent fixture that we have ever offered. Constructed of heavy gauge metal with lustre white enamel finish. All General Electric high power factor ballasts. Furnished with General Electric 36", 30 watt white fluorescent lamps. Fixture may be mounted next to the ceiling or suspended on chains. These fixtures are beautifully constructed. Use them over your service bench, in your display room or in your office. Brand new in factory cartons properly packed for shipment. These fixtures sold for up to $30.00. We bought a truck loads and are passing our bargain on to you. Why pay more than this to modernize your shop. Shipping weight 26 lbs. each. Shipped via Express, Rail Freight or Truck only. Stock No. MK-430 fixture complete, Net **$12.95**; 2 for **$25.00.**

DELUXE MODEL WITH GLASS, $14.95; CEILING CANOPY, $1.95

Bottom Illustration

Deluxe Model No. MK-430X, same as No. MK-430 described above with the exception that it has translucent glass over the lamps to diffuse the light. CEILING CANOPY that is shown, **$1.95 extra.** Shipping weight 33 lbs. Net price **$14.95**; 2 for **$28.00.**

Canopy for suspending either of the above fluorescent fixtures 30" from the ceiling. For use where it isn't advisable to mount fixture flush or suspend it on chains. Canopy kit is complete with stamped metal box cover with hardware for mounting to any outlet box and 2—36" lengths of 3/8" white enameled tubing. Ship. wt. 6 lbs. Fixture canopy kit, No. I-30, **$1.95.**

CAPEHART CABINET, $79.95
BLANK OR CUT TO FIT ESPEY CHASSIS

Buy this cabinet with Espey chassis and the VM changer listed above and have a fine radio-phono combination for less than the value of the cabinet alone. This beautiful cabinet was intended for a Capehart $800.00 combination. It is the finest possible furniture quality cabinet workmanship, 37" high, 40" wide and 21" front to back. Hinged top lifts in two sections, 25½" lid covers the changer compartment and 14½" is the width of the radio compartment. Changer mounting panel is furnished blank. Radio panel is shipped ready cut to fit the 7-C Espey chassis. Baffle is cut to hold 2—12" speakers. Made of top quality walnut veneer, ¾" material used throughout. Shipped via truck, rail or express only. Shipping wt., 160 lbs. Stock No. C-175, with panel cut to fit Espey 7-C, **$79.95.** Stock No. B-175B, with blank changer and radio panel, **$79.95.** Buy 2—12" 32 oz. Alnico PM speakers for use in this cabinet for only **$15.00** ($7.50 each).

SENSATIONAL 50-WATT BOOSTER AMPLIFIER, $39.95
2 MIKE PRE-AMP, $12.95 EXTRA

50-WATT BOOSTER A sensational value, 50 watt booster amplifier with push-pull parallel 6L6 output tubes. Connect to your present amplifier as a booster or use with the PR-2X Pre-amp to add the use of 2 mikes and one low level input. The booster amplifier has one input pack and with 1 volt input gives 50 watts of audio. Booster has a 6 lb. potted case high fidelity output transformer, matches speaker with 4-8-16 ohm voice coil, also 60 ohm and 250 ohm line. Booster has a 225 mill power supply with 5U4 rectifier. Five tube variable controls are for master volume control and base boost tone control. Size 8x8¼x14½, Stock No. PA-55X, Shipping weight 26 lbs. Sale price **$39.95** ea.

2-MIKE PRE-AMP, Pre-amplifier pluga in directly to the PA-55X Booster-amplifier. It enables use of 2, Crystal or Dynamic Mikes plus one low level input. Furnished with 4 foot cables and plugs for remote control of the 55 watt Booster Amplifier. Small chassis size 5x3¼x4", Stock No. PR-2X, with tubes 7F7 and 7N7. Net price **$12.95.**

McGEE'S $62.50 LIST 15" COAXIAL SPEAKER, $24.95
21 OZ. ALNICO V MAGNET—5" TWEETER

This is the finest 15" coaxial PM speaker value that we have ever offered. New 1952 production, of a famous manufacturer of fine speakers. The 15" speaker has 21¼ oz. magnet equal to 68 oz. of the Alnico 3 type magnet. The cone is free floating, of one piece construction. Will reproduce low frequencies down to 20 cps. The 5" tweeter is coaxially suspended and has a ridged cone to reproduce only the high frequencies. It will respond up to 17,500 cps. The high-pass filter is concealed under the pot cover, leaving only two wires to connect both the tweeter and woofer to any 8 ohm output transformer of a radio, or high fidelity music lover's amplifier. Stock No. P15-CR, shipping weight 13 lbs. Net price **$24.95**; 2 for **$47.95.**

12" COAXIAL SPEAKER, $12.95

McGee offers the new 1952 model 12" coaxial PM speaker. Quality you would find in your finest sets if you were a manufacturer. 12" woofer has 6.8 oz. Alnico V magnet. Tweeter is coaxially suspended and has a metal diffuser. High pass filter is under the pot cover. Only two wires to connect to your radio or audio amplifier. 8 ohm with 18 watt peak and 10 watt average. Shipping weight 8 lbs. Response from 30 to 17,500 cps. Stock No. CU-14Y, Sale price **$12.95** each; 2 for **$25.00.**

12" JENSEN PM, $15.95

Another McGee Scoop! Jensen Concert 12", 14½ oz. Alnico V magnet PM speaker, 8 ohm voice coil. Will take 25 watt audio. You save dollars on this speaker. Just 100 to sell. Shipping weight 8 lbs. Stock No. P-12F. Sale price **$15.95**; 2 for **$30.00.**

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8" PM AND LEATHERETTE BAFFLE, $4.95 LOTS OF 10, $4.75

The finest Leatherette Baffle we have ever offered. New self-supporting plastic grill material, baffle is covered tan with matching grill. Offered with a good heavy duty 8" Alnico V PM speaker with 3.2 ohm voice coil, Stock No. 818. Speaker and Baffle, **$4.95** ea.; lots of 10, **$4.75.** 8" Baffle only. Stock No. NV-8, **$2.29** ea.; 10 for **$19.95.**

12" PM AND WALNUT BAFFLE, $9.95
LOTS OF 3, $8.95

The finest built 12" Walnut plywood wall baffle we know of. Factory cost of the famous Juke box manufacturer exceeds $7.00, we offer with a 12" PM for little more. You pay only **$9.95** in single lots, or **$8.95** in 3 lots for both a 12" Quam Alnico V PM with 3.2 ohm voice coil and the beautiful wall baffle. Speaker Baffle combination, Stock No. BS-12G, **$9.95** ea.; lots of 3, **$8.95** ea. 12" Baffle only, 2SEG-12, **$4.95** each.

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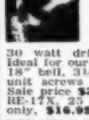
You get a heavy 8" PM speaker in a leatherette-covered plywood baffle with 20 feet of connecting cable and variable volume control for use with any radio, TV set or amplifier. Just connect to any 3 to 8 ohm output transformer secondary. Stock No. ID-52, **$7.95** each; 2 for **$15.00.** Shipping weight 6 lbs.

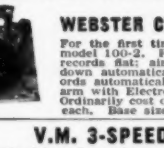
MIKES AND STANDS AND TRUMPETS



4D-T, high impedance dynamic mike with 12 feet of cable. Sale price, **$10.95.** 35" to 64" chrome floor stand for mike, **$5.88.**

30 watt driver and trumpet, 15 ohms. Ideal for our 50 watt booster. Trumpet has 18" bell, 3½ ft. reflex air column. Driver unit screws on. Stock No. XX100-RM35. Sale price **$28.95.** RE-17X, 25 watt paging speaker for voice only, **$16.95** each.

3-SPEED CHANGERS ON SALE AT McGEE



WEBSTER CHICAGO MODEL 100-2 ONLY $26.95

For the first time we offer the world famous Webster-Chicago, model 100-2. Features a newly designed spindle, that drops the records flat; air-cushioned to the turntable. Pickup arm sets down automatically after the last record plays. Plays all records automatically, 33⅓, 78 and 45 rpm. New balanced tone arm with Electro-Voice Tilt-A-Matic cartridge with dual needles. Ordinarily cost over **$37.00.** McGee offers them for only **$26.95** each. Base size 12"x12¾". Shipping weight 14 lbs.

V.M. 3-SPEED MODEL 406 $22.95

VM model 406, deluxe 3 speed automatic record changer. Plays them all. Intermixes records of the same speed. Equipped with a flip over crystal pickup with twin needles. Base size, 12¼x13". Shipping weight 12 lbs. VM-406. Net price **$22.95.**

G.I. 3-SPEED CHANGER WITH G.E. $22.95
VARIABLE RELUCTANCE TURN-ABOUT CARTRIDGE

Another tremendous McGee Scoop! Brand new General Instrument 3-speed automatic record changers. Complete with RPX-050 G.E. variable reluctance cartridge with turn-about stylus. Plays all 3 speeds automatically 7", 10" or 12" records. Has reject button. Repeats last record. Base size, 12"x12⅞". Shipping weight 14 lbs. Stock No. 700-GE. Scoop price, **$22.95.**

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1H5	.59	6AV6	.49	6SF7	.69	12AV6	.49
1J6	.59	6BA6	.49	6SG7	.69	12AX4GT	.69
1L4	.59	6BA6	.59	6SH7GT	.69	12AX7	.69
1LA4	.79	6BA6	.59	6SK7GT	.69	12BA6	.59
1LC5	.79	6BC5	.59	6SL7GT	.69	12BA7	.69
1LE3	.79	6BE6	.59	6SN7GT	.69	12BE6	.59
1LG5	.79	6BQ6G	1.29	6SU7GT	.69	12BF6	.59
1LN5	.79	6BH6	.59	6U7G	.69	12J5GT	.69
1R5	.59	6BJ6	.59	6V6	.59	12J7GT	.69
1S5	.59	6BQ6GT	.99	6V6GT	.59	12K7GT	.69
1T4	.59	6C4	.49	6V6GT	.59	12K8GT	.69
1U4	.59	6C5	.59	6X4	.49	12SA7GT	.59
1U5	.59	6C8G	.59	6X5GT	.49	12SF5GT	.59
1V2	.59	6CD6G	1.49	6X8	.79	12SJ7GT	.59
3A4	.69	6H6GT	.59	6ZY5G	.59	12SK7	.59
3Q4	.69	6J5GT	.49	7B6	.69	12SQ7GT	.59
3V4	.69	6K6GT	.49	7C5	.69	12SR7	.59
5T4	1.49	6K7GT	.59	7E6	.69	14A4	.89
5U4	.49	6K7G	.59	7E7	.89	14B6	.99
5V4	.69	6K8G	1.09	7N7	.79	14H7	.79
5Y3	.40	6L7G	1.09	7N7	.59	14M7	.79
6AB4	.69	6P5GT	.59	7V7	.99	14Q7	.99
6AJ5	1.49	6R7	.59	7X7	.99	117Z3	.89
6AK5	.99	6S4	.59	7Y4	.79	25B6GT	.99
						25L6GT	.99
						25Z6GT	.79
						35A5	.59
						35L6GT	.59
						35W4	.49
						35Z5GT	.49
						35/51	.69
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						37	.79
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						45	.89
						50B5	.59
						50C5	.59
						50L6GT	.59
						57	.49
						58	.49
						75	.69
						77	.69
						78	.69
						80	.49
						89	.79
						117L7GT	1.49
						117Z3	.89
						955	.79

100 Molded Plastic Bypasses $9.95

100 molded plastic tubular bypass condensers, All 600 volt. And all by the nine nationally known mfgr. Regular dealers' net is over two and one-half times our 20th Anniversary sale price. You'll wonder when you look these over. Here's what you get: 10—.001, 10—.002, 20—.005, 20—.01, 20—.02, 10—.05 and 10—.1. Our big deal No. RN-202. 100 plastic tubulars. Shipping weight 2 lbs. Net price, **$9.95.**

SELENIUM RECTIFIERS

65 mil Selenium Rectifier, net . . . . . **.59c** each
100 mil Selenium Rectifier, net . . . . . **.75c** each
150 mil Selenium Rectifier, net . . . . . **.89c** each
200 mil Selenium Rectifier, net . . . . . **$1.19** each
250 mil Selenium Rectifier, net . . . . . **$1.29** each

350 mil Selenium Rectifier, net. **1.39** each
450 mil Selenium Rectifier, net. **1.79** each
McGee offers you the finest in Selenium rectifiers. All standard 130 volt.

5 0Z4 TUBE & 5 VIB. DEAL No. RN-V5 . . . $9.50

Here's a red-hot deal for you fellows that do a lot of auto radio service. 5 standard brand metal 0Z4 tubes and 5 of our famous 4-prong serrated can vibrators. This vibrator is of the latest design, for long life. Standard diameter can, short enough to fit all Chrysler auto sets, also fits Motorola, etc. Our 20th Anniversary, big deal No. RN-V5. You can get 5 0Z4 metal tubes and 5 4-prong vibrators, all for **$9.50.** Shipping weight 3 lbs.

3-STATION INTERCOM MASTER, $14.95
USE UP TO 3-SUB STATIONS, $4.49 EACH

A red-hot intercom master value. A full 3 tube, 110 volt AC-DC master, with 3 station selector switch and easy accessible volume control. Small compact size, 5"x 6"x6½" high. Makes an attractive intercom installation. May be used with from one to three of our G-4T substations described below. Intercom master is quiet at all times, except when press-to-talk switch is pressed at either the master, or one of the subs. Shipping wt, 5 lbs. Stock No. KA-3, master station, less subs. Net **$14.95.** Stock No. G-4T, brown plastic substation, with Alnico V PM speaker and press-to-talk switch. May be purchased with or without master station. Shipping weight 2 lbs. Net, **$4.49** ea.
3 wire plastic intercom cable, 100 ft. **$1.95;** 500 ft. **$8.95.**

50-W. OUTPUT TRANS. ONLY $7.50 WHY PAY MORE

50-watt super quality high fidelity output transformer. Matches push-pull parallel or push-pull 6L6 tubes to 4/8/16-ohm voice coil, also 60 to 250 ohm line. Very efficient winding construction only 140 ohms total resistance in primary, and 8-ohm voice coil tap only .2 of an ohm. This output transformer wastes a minimum amount of audio power due to heat loss within the transformer. Very ideal for public address amps. Stock No. 50-JB, net weight 5¼ lbs. Bargain price **$7.50** ea.; 2 for **$13.95.**

TELEVISION FRONT ENDS on SALE at McGEE—STANDARD COIL, RCA, SARKES-TARZIAN

STANDARD COIL CASCODE TUNER $19.95

The Cascode Circuit of the Standard Tuner offers a new development of this famous TV front end assembly which affords a 2-to-1 improvement in gain and a 33⅓% to 50% reduction of noise over the pentode tuner. Other advances include: easy conversion to UHF reception by interchange of channel inductors; increased sensitivity for TV sets in fringe areas; elimination of booster use; and a high profit item for the serviceman as a replacement unit sale. Brand new factory cartoned. Series TV-2000 TV tuner, compl, with tubes 6BK7 or 6BQ7 and a 6J6. Scoop price, **$19.95** ea.

THE ORIGINAL STANDARD COIL TV TUNER ANOTHER McGEE SCOOP $12.95

5 million of this same tuner have been used in TV production. The most widely used of all TV tuners. Price includes tubes: 6J6 and 6CB6 or 6AG5. You save over 50 percent by ordering one of these tuners from McGee. Two different shaft lengths are available. Stock No. SC-947, 2½" shaft length, with tubes and ⅜" concentric shaft fine tuning. Channel selector shaft is standard ¼" and is insulated from the coil drum. SC-947 net price with tubes, **$12.95** each, 2 for **$25.00.** Stock No. SC-948, 5" shaft length with tubes and ⅜" concentric shaft fine tuning. SC-948 net price, **$13.95**, 2 for **$27.00.** Both tuners are 12 channel, complete with snap in coils.

GENERAL INST. T.V. TUNER $7.95

This popular General Instrument TV tuner has been used on thousands of late model TV sets. It has built-in fine tuning and 13 channel selector control. This tuner differs from other tuners in that it is built around a 6 position inverted turret switching arrangement. A convertor coil is not mounted on this tuner. Priced complete with 3—6J6 tubes. Shipping wt., 3 lbs. Stock No. GI-WT3, with tubes. Net price, **$7.95.** Specify shaft length desired, either 1¾" or 7".

$2.95 SPECIAL. GI-312, same as above GI Tuner only less tubes and in repairable condition. 1¾" and 7" shafts available.

3-TUBE SARKES-TARZIAN T.V. TUNER $9.95

This popular Sarkes-Tarzian Type 3 tuner is widely used. 13 channel rotary type switch with individually tuned coils. Price is complete with diagram and three tubes: 6C4 osc., 6BH6 R.F. and 6AG5 mixer. Regular factory cost is twice our price. Each tuner is wired ready to hook up to a video and sound IF strip. May be used with either inter-carrier or separate sound IF circuits. Has built-on convertor coil, built in fine frequency control. Sarkes-Tarzian TV tuner, with 3 tubes. Net price, **$9.95** each. Specify shaft length, either 2⅞" or 4¾".

RCA 201E1 T.V. TUNER $7.95

Terrific buy on this RCA tuner. We have a limited quantity of the famous original 201E1, 13 channel completely wired and tested TV front end tuners. Ready to connect to your TV video I.F. strip. Offered at a sacrifice. Price was $41.00. Now only **$7.95** each, with tubes. Each tuner in good condition but has been repaired. Stock No. RCA-13P, TV front end tuner. Convertor coil type for separate sound as used in the famous 630 chassis. Complete with 3—6J6 tubes, **$7.95.** Specify shaft length desired, either 2" or 4".

WIRED VIDEO I.F. STRIP $3.95

This wired video I.F. strip is a perfect replacement for several model Crosley TV sets, such as Model No. 11-442MU, 11-446MU and many others. Offered at less than the factory production cost. 5 tubes are required: 2 6AU6, 1st and 2nd video, 6AL5 video detector and either 2 6AG5 or 2 6BC5 3rd and 4th video, 1st I.F. 22.9 mc, 2nd 26.55 mc, 3rd, 22.2 mc, 4th 24 mc. This strip has dozens of resistors, ceramic capacitors and slug tuned I.F. coils. Ideal for set builders, or perfect to replace parts from TV servicing. Stock No. CR-51F, **$3.95** each. Kit of 5 tubes for this I.F. strip, **$3.50** extra.

TELEVISION CLARIFIER $4.41

New and improved Precision TV clarifier removes annoying signals that cause distortion on TV receivers by FM, amateur, shortwave, diathermy, ignition and adjacent channel interference. Ghosts, tears and wavy effects are removed or greatly reduced simply by adjusting the two control knobs on the new type interference eliminator. Connects into the antenna lead-screw to set. Model TVC Precision Clarifier, net price **$4.41**, or two for **$8.50.**

Picture Tube Reactivator $14.95

Rejuvenate that old picture tube that has lost its brilliance. Will reactivate some of the picture tubes that have been removed from sets. Only a few minutes required to increase tube emission. Rytel Reactivator, Model RTR-50, Net price **$14.95.**

SARKES-TARZIAN—SPEC. $2.95

Type 4, Sarkes-Tarzian 12 channel TV tuner. Requires 2 6AG5 or 2 6BC5 and a 12AT7. Has ¼" diameter shaft, 2⅝" long. Screwdriver slot fine tuning adjustment. It differs from other tuners in that it has no concentric fine tuning shaft over the channel selector shaft. Very fine for experimental use, building field strength meters, etc. Sarkes Tarzian Type 4. TV tuner less tubes, **$2.95.** Set of 3 tubes for this tuner, **$1.80** extra.

SNOW FILTER FOR FRINGE AREA

Reduces glare, increases contrast. Easily installed with double faced adhesive supplied with filter. Available in Blue or Smoke color, in sizes for 16" to 20" screen.

No. 126, 12" x 16" for 16 and 17" tubes, Blue or Smoke, **$1.98** ea.

No. 152, 15" x 20" for 20" TV screen, Blue or Smoke, **$2.65** ea.

14 KV FLYBACK ONLY $2.95

Genuine General Electric flyback made for Arvin. Conventional type for 70° deflection yokes and all 14", 16", 17", 20" and 21" rect. tubes. Delivers up to 14,000 volts. Has fiber punched for 1x2 rectifier socket. Used with 6BQ6, 6BG6 or 6CD6 horizontal output and 1B3 or 1x2 rectifier. Schematic with each terminal identified is furnished. No. T-7733, **$2.95** each. **$2.50** each in lots of 5 or more. 70° Deflection Yoke **$2.95** extra.

GENUINE STANDARD COIL T.V. BOOSTER $11.95

Not Surplus, But Right From the Factory

Latest Model B-51 Standard Coil Television Booster. McGee makes another lucky purchase and as usual, passes the saving on to you. The famous Model B-51, 12 Channel Standard Coil TV booster, which lists for $35.00, is offered to you for only **$11.95** each, brand new, factory cartoned and fully guaranteed by McGee. This top quality single stage booster utilizes printed high frequency circuits, for improved performance on all channels. Uses 6AK5 tube. Average gain, 6 to 7 volts on low channels and 5 or 6 on high channels. No distorting of picture or sound. Has extremely low noise factor. Continuous one-knob tuning and channel selector control switch for off-on and by-passing 300 ohm lead-in to set. Modern design, dark brown plastic cabinet, 8"x4¼"x4½". Made for 110 volt, 60 cycle AC operation. Shipping weight 5 lbs. Model B-51, Sale price, **$11.95** each, or buy 2 for only **$22.00.**

McMURDO SILVER BOOSTER $10.95

Sensational value. Continuously variable inductance type tuner, from channel 2, including the FM band, through channel 13. This booster is self powered for 110 volts AC operation. Incorporates a 6J6 tube. Input for 300 ohm TV line and 300 ohm output to the TV set. Single knob tuning. Attractive plastic case. McMurdo-Silver Super Sonic TV-FM booster. Stock No. GB-6B. Shipping weight 5 lbs. McGee's terrific sale price, **$10.95** each, **two for $20.00.**

1952 MODEL ASTATIC $19.10

New Astatic "Scanafar" TV booster with improvements to match the newer model TV receivers. Has more than maximum gain. Balanced cascaded circuit with 6J6 and 6BQ7. Input and output for both 72 and 300 ohm. Mahogany finished metal cabinet 6½x4¾x4¾" high. Model CT-1. Net price **$19.10.**

1952 MODEL REGENCY $19.10

New Regency DB-520 TV booster with exclusive circuit stabilizer and newly designed cabinet only 4½x5¾x4½". Improved circuit with push-pull 6J6 is equal to the best cascode circuits and has higher gain. Matches 72 or 300 ohm, Net price **$19.10.**

ALLIANCE TENNE ROTORS $26.43

Two trouble free models to choose from. Model HIR automatically aims antenna at the station you select. Just set pointer to the position desired. Model DIR starts, stops and reverses instantly. Meter shows antenna position at all times. Both have fully encased motors. Operates on 110 volts. Net price for either, **$26.43.** Use 4 wire connecting cable, .04 per ft., extra.

300 OHM T.V. LEAD IN $12.95

Best quality 300 ohm TV lead in wire. 55 mil polyethlene with 22 gauge stranded copper conductors. Will not crack and break up in extreme heat or cold. Genuine Plastoid branded, not surplus. Stock No. P-3126, **$12.95** per 1000 ft. metal spool.

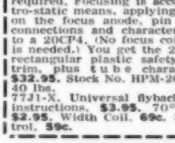
Open line TV lead in. Copperweld, 1/6 the loss of regular 300 ohm. For fringe area reception. **$4.95** per 100 ft. 250 ft. for **$12.00.** 500 ft., **$22.95.**

CUSTOM BUILT TO FIT AUTO RADIOS

6 tube superheterodyne 3 gang tuning. Custom Built to fit individual makes of cars. Simple to install, no cables or drilling necessary. Packed in original factory cartons.

Made for	List Price	Your Price
'49 and '50 Ford. .	$59.95	**$39.97**
'49, '50 Dodge, Plymouth	59.95	**39.97**
'49 & '50 Chevrolet	59.95	**41.97**
1951 Ford	59.95	**39.97**
1952 Ford	59.95	**39.97**
'51 and '52 Dodge	59.95	**39.97**
'51 & '52 Chevrolet	59.95	**39.97**
'48 thru '52 Hudson	59.95	**39.97**
'50 thru '52 Studebaker	59.95	**39.97**
'51 & '52 Plymouth	59.95	**41.97**
1951 & Henry J. .	59.95	**39.97**
Universal Underdash	49.95	**32.97**

NOW YOU CAN CONVERT TO A 17" OR 20" PICTURE TUBE WITH ELECTRO STATIC FOCUS



The 17HP4 and 20HP4 are 17" and 20" black face picture tubes of the electromagnetic deflection electrostatic type of focusing. Focusing is accomplished by a 5 meg. pot connected as a bleeder between ground and the cathode of the damper tube. The arm of the focus pot connects to pin 6 of the CR tube, to apply a focus voltage of from 0 to 300 volts. This new type tube is called low voltage electrostatic focus. Very simple to use and operate from 8.5 KV to 14 KV. Most set makers are using this new tube in several models. The trend is almost completely to this type gun.

20" CONVERSION KIT $32.95

The new 20HP4 blackface picture tube operates from 10 to 14KV, high voltage. It is the conventional 20" rectangular shape A standard 70° yoke and single ion trap are required. Focusing is accomplished by electro-static means, applying from 0-300 volts on the focus anode, pin No. 6. All other connections and characteristics are similar to a 20CP4. (No focus coil or focus magnet is needed.) You get the 20HP4 tube, a 20" rectangular plastic safety mask with gold trim, plus tube characteristics, all for **$32.95.** Stock No. HPM-20, shipping weight 40 lbs.

77J1-X. Universal flyback with connecting instructions, **$3.95.** 70° Deflection Yoke, **$2.95.** Width Coil. **69c.** 5 meg. focus control. **59c.**

17" CONVERSION KIT $24.95

The new 17HP4 blackface picture tube operates from 8 to 14KV, high voltage. It is the conventional 17" rectangular shape. A standard 70° yoke and single ion trap are required. Focusing is accomplished by electro-static means, applying from 0-300 volts on the focus anode, pin No. 6. All other connections and characteristics are similar to a 17HP4. (No focus coil or focus magnet is needed.) You get the 17HP4 tube, a 17" rectangular plastic safety mask with gold trim, plus tube characteristics, all for **$24.95.** Stock No. HPM-17. Shipping weight 30 lbs.

77J1-X, Universal Flyback with connecting instructions, **$3.95.** 70° Deflection Yoke, **$2.95.** Width Coil, **69c.** 5 meg. focus control. **59c.**

14" CONVERSION KIT $19.95

You get an RCA 14" rectangular blackface picture tube, plus a 14" plastic safety escutcheon, plus a 70° deflection yoke, plus a 14,000 volt flyback transformer, all for **$19.95.** Stock No. RC-14X Conversion diagram furnished.

10" PICTURE TUBE $14.95

10MP4, 10" picture tube made by Sylvania. Perfect replacement for 10BP4, no circuit changes required. Brand new factory cartoned. Net price 10MP4, **$14.95** each.

COMPLETE RADIO, TELEVISION AND AMPLIFIER KITS AT McGEE

3-WAY PORTABLE KIT $15.95

A NEW '52 MODEL

New 1952 Model 3-way personal portable radio kit. Operates on 110 Volts AC-DC or 67½ B plus 1½ volt self-contained batteries. Leatherette covered case size, 5½x5¾x8". Receives broadcast 550 to 1650 Kc. A conventional 2-gang superhet circuit with 456 KC iron core IF's. Incorporates the new super gain stick loop antenna. All plated chassis. Lab. approved circuit—matched parts. Price includes all parts, tubes, diagram, Alnico V PM speaker. A factory quality kit. Stock No. PN-4T, shipping weight 7 lbs. The complete kit. Less batteries **$15.95.** 67½V. B, **$1.59.** 1½v. A, **39c** extra.

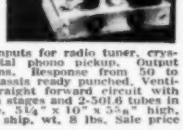
Build Your Own Phono-Mike Broadcaster $7.95

Kit Model DE-6R. With this simple kit, you can build a 3-tube phono oscillator that also has a mike input. Will broadcast over any radio, within your home, (about 75 feet) from 1000 to 1500 kc. Inputs for crystal mike or crystal phono pickup. Fader control fades from mike to record. Ideal for a home P.A. system, baby listener and home entertainment. A complete kit of parts including tubes. Kit Model DE-6R. Net price, **$7.95.** DE-6RWT, wired and tested. Net price, **$9.95.** Crystal mike and desk stand, **$4.95 extra.** Concealed microphone unit, only 1" in diameter and ¼" thick. Specify hidden mike when ordering. Stock No, T-001. Net. **$3.98** extra.

8-Tube Hi-Fi Amplifier Kit $29.95

A complete kit, including tubes: 5-7E5, 2-7F7, 2-6A3, plus rectifier diagram and photos. Inputs for radio tuner and any kind of phono pickup crystal or G.E. variable reluctance and either crystal or dynamic mike. Output matches 8 ohm voice coil. Twin electronic bass and treble tone control with ranger selector switch for either juke box quality with heavy bass response or brilliant symphonic range. Response 18 to 20,000 cps. 8 tube all triode amplifier kit, complete with tubes. Shipping weight 25 lbs. Model 7X5. Net **$29.95.**

10-Watt Hi-Fi Amplifier Kit $14.95

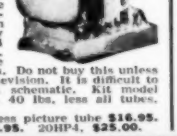


A complete kit of parts including tubes 12AX7, 12AU7, 2-50L6, plus rectifier, diagram and instructions to build a high fidelity 10 watt control audio amplifier with bass and treble boost. Inputs for radio tuner, crystal mike and crystal phono pickup. Output matches 8 ohms. Response from 50 to 15,000 cps. Chassis ready punched. Ventilated cover. Straight forward circuit with twin triode gain stages and 2-50L6 tubes in push-pull. Size, 5¼" x 10" x 5⅝" high. Model AP-10R, ship. wt. 8 lbs. Sale price **$14.95.**

10-TUBE RADIO KIT $29.95

10 tube broadcast radio chassis kit, complete with tubes: 2-6SK7, 6SA7, 6H6, 6SQ7, 2-12AX7, 2-6V6 plus rectifier, dial, diagram and instructions. 3 gang superhet with 8" slide rule dial. Chassis size, 12½"x10"x8½" high. Features push-pull 6V6 high fidelity audio. Output matches 3 to 8 ohm voice coil speakers. Inputs for G.E. variable reluctance or crystal phono pickup and crystal mike. Heavy duty power transformer. Model BK-R10 kit less speaker, shipping weight 18 lbs. Net **$29.95.**

17, 20" T.V. Kit $59.95 Less Tubes



A complete kit of parts to build an AC transformer operated television chassis for use with a 16", 17" or 20" rectangular picture tube. The 12 channel Sarkes-Tarzian tuner is ready wired, as is the 4 tube video IF strip. Circuit is of the conventional design. Do not buy this unless you understand Television. It is difficult to wire. We furnish schematic. Kit model WH-20. Ship. wt. 40 lbs. less all tubes. Net **$59.95.**

Kit of 19 tubes, less picture tube **$16.95.** 17" 17BP4A, **$19.95.** 20HP4, **$25.00.**

6-TUBE 2-BAND KIT $14.95

Popular with schools and colleges for training. 6 tube AC-DC, 2 band radio kit with plastic cabinet. Receives broadcast and 6 to 18 mc shortwave. Built 2 gang superhet with 5" speaker and slide rule dial. A complete kit with tubes: 12SK7, 12SK8, 12SK7, 12S07, 35L6 and 35Z5, diagram and instructions. Factory quality. Cabinet size 13"x6¾"x6¼". Shipping weight 12 lbs. Model MEG-2. Net **$14.95.**

5-TUBE AC-DC KIT $12.95

Model RS-5. A 5 tube AC-DC straight broadcast kit, housed in the same cabinet as MEG-2 above. Complete with tubes. Shipping weight 10 lbs., Net **$12.95.**

AC POWERED BROADCAST TUNER KIT $12.95

A self-powered, 3-gang superhet tuner kit with R.F. stage. This complete kit is furnished with a diagram, photos and tubes, 6AU6 R.F., 6BE6 oscillator R.F., 6AU6 I.F. detector, 6AL5 diode, AVC, plus rectifier. Connect to any audio amplifier. Ideal for use with our S-2020, TM-16 or 7x5 amplifier kits. Chassis size, 9½x4x4½" high. Shipping weight, 7 lbs. Broadcast tuner kit Model BT-38X. Net price, **$12.95.**

WHAT'S *New in Radio*

For additional information on any of the items described herein, readers are asked to write direct to the manufacturer. By mentioning RADIO & TELEVISION NEWS, the page, and the issue number, delay will be avoided.

SCOPE CALIBRATOR

Simpson Electric Company, 5200 W. Kinzie Street, Chicago, Illinois has developed a new lightweight oscilloscope

calibrator which has been designed as a companion piece to the company's Model 476 Mirroscope.

The Model 276 calibrator is completely self-contained and operates from 117 volts, 50 or 60 cycles. It may be used with any oscilloscope. The unit has a sine-wave output which is used directly on the 4½ inch meter. The meter is calibrated directly in r.m.s., peak, and peak-to-peak values. Six ranges are provided with peak-to-peak full scale values of 1, 2.5, 10, 25, 100, and 250 volts with an accuracy of 3%. Each range is continuously adjustable from zero to full-scale values.

EICO MULTIMETER

Electronic Instrument Co., Inc., 84 Withers Street, Brooklyn 11, New York has added a new multimeter to its line of test equipment.

The Model 566 multimeter is a 1000

ohms-per-volt unit which is available in either kit or factory-wired form. It has a 4½", 400 μa. meter movement and features 31 different 1000 ohms-per-volt ranges.

Specifications include a.c. and d.c. voltage in six ranges (0-1, 5, 10, 50, 500, and 5000); a.c. current in four ranges (0-1, 10 ma., .1 amp. and 1 amp.); ohms in three ranges (0-500, 100,000, and 1 megohm); and six db ranges (−20 to +69).

The unit is housed in a high-impact Bakelite case measuring 6¾" x 5¼" x 3". In kit form, the multimeter has been designated as the Model 566K.

LIGHTWEIGHT HEADSET

Telex, Inc., Telex Park, St. Paul 1, Minnesota has developed a specially designed headset which incorporates several new features.

The new "Dynaset" model, with under-the-chin styling, weighs 1.25 ounces. According to the company, the headset has a higher fidelity range, permitting more exact reproduction of highs and lows of both music and speech.

The unit is suitable for radio mon-

itoring, ham radio, electronic laboratories, commercial communications, etc.

EQUALIZER-PREAMP

Hermon Hosmer Scott, Inc., 385 Putnam Avenue, Cambridge 39, Massachusetts is currently introducing a new equalizer-preamplifier which has been designated as the 120-A.

This new unit provides versatile remote-control and compensation for music reproduction. Professionally, the instrument is used by broadcast stations and, for home use, it may be used with existing power amplifiers or with the company's 220-A amplifier.

The record-compensator adjusts for virtually all recording characteristics and levels. Treble roll-off and bass turnover equalization are provided on 8 positions, including 5 for standard records and 3 for long-playing records. Combined with the equalization is a 3-position input-selector for a tuner, TV, etc. Featured are 3-channel, continuously adjustable treble and bass

BUY TEST EQUIPMENT
ON THIS RADICALLY NEW
TIME PAYMENT PLAN

NO INTEREST!! - NO CARRYING CHARGES!!

USE CONVENIENT TIME PAYMENT ORDER BLANK BELOW

Superior's New

JUNIOR SUPER-METER

MOST COMPLETE AND COMPACT MULTI-SERVICE INSTRUMENT EVER DESIGNED

Measures: * Voltage, * Capacity, * Current, * Reactance, * Decibels, * Resistance, * Inductance

Specifications: D.C. Volts: 0-7.5/75/150/750/1500 Volts. A.C. Volts: 0.15/150/300/1500/3000 Volts. Resistance: 0-10,000/100,000 ohms. 0-10 Megohms. D.C. Current: 0-7.5/75 Ma. 0-7.5 amps. Capacity: .001 Mfd.—2 Mfd. .1 Mfd.—20 Mfd. Electrolytic Leakage: Reads quality of electrolytics at 150 Volt test potential. Decibels: —10 Db to +18 Db. + 10 Db. to + 38 Db. + 38 Db. to + 58 Db. Reactance: 15 ohms—25 K ohms 15 K ohms—2.5 Megohms. Inductance: .5 Henry—50 Henries 30 Henries—10 K Henries. Plus Good-Bad scale for checking the quality of electrolytic condensers.

Handsome round cornered molded bakelite case 3⅛" x 5⅞" x 2¼" complete with all test leads and instructions ..... **$21.40 NET**

Superior's New Model TV-11

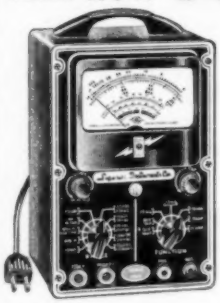
TUBE TESTER

• Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary. • Uses no combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket. • Free-moving built-in roll chart provides complete data for all tubes. • Phono jack on front panel for plugging in either phones or external amplifier detects microphonic tubes or noise due to faulty elements and loose external connections.

Operates on 105-130 Volt 60 Cycles A.C. Hand-rubbed oak cabinet complete with portable cover ..... **$47.50 NET**

Superior's New Model 670-A

SUPER-METER



***A COMBINATION* VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS**

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts.
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts.
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes.
RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Quality test for electrolytics)
REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
DECIBELS: —6 to +18 +14 +38 +34 to +58

The Model 670-A comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 6¼"x9½" x4½". **$28.40 NET**

ADDED FEATURE:
The Model 670-A includes a special GOOD-BAD scale for checking the quality of electrolytic condensers at a test potential of 150 Volts.

Superior's New

TV BAR GENERATOR

Throws an Actual Bar Pattern on Any TV Receiver Screen!!

Two Simple Steps:

1. Connect Bar Generator to Antenna Post of any TV Receiver.
2. Plug Line Cord into A.C. Outlet and Throw Switch.

RESULT: A stable never-shifting vertical or horizontal pattern projected on the screen of the TV receiver under test.

Power Supply: 105-125 Volt 60 Cycles. Power Consumption: 20 Watts. Channels: 2-5 on panel, 7-13 by harmonics. Horizontal lines: 4 to 12 (Variable). Vertical lines: 12 (Fixed). Vertical sweep output: 60 cycles. Horizontal sweep output: 15,750 Cycles.

TV Bar Generator comes complete with shielded leads and detailed operating instructions. Only NET $39.95

New Model 200 AM and FM

SIGNAL GENERATOR

Provides complete coverage for A.M.-F.M. and TV alignment

• R.F. Frequency Ranges: 100 Kilocycles to 150 Megacycles. • Modulating Frequency: 400 Cycles. May be used for modulating the R.F. signal. Also available separately. • Attenuation: The constant impedance attenuator is isolated from the oscillating circuit by the buffer tube. Output impedance of this model is only 100 ohms. This low impedance reduces losses in the output cable. • Oscillatory circuit: Hartley oscillator with cathode follower buffer tube. Frequency stability is assured by modulating the buffer tube. • Accuracy: Use of high-Q permeability tuned coils adjusted against 1/10th of 1% standards assures an accuracy of 1% on all ranges from 100 Kilocycles to 10 Megacycles and an accuracy of 2% on the higher frequencies.

* Tubes used: One 954 as oscillator; one 954 as modulated buffer amplifier; T-2 as modulator; 7193 as rectifier.

The Model 200 comes complete with output cable and operating instructions ..... **$21.85 NET**

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Dept. B-28, 38 Murray Street, New York 7, N. Y.

Please send me the units checked below. I am enclosing the down payment with order and agree to pay the monthly balance as shown. It is understood there will be no carrying, interest or any other charges, provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

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City..... Zone..... State.....

controls, each of which comprise 3 conventional tone circuits, one boosting, one flat, and one attenuating.

A free bulletin giving complete specifications on the 120-A is available from the company on request.

WIRE STRIPPER

The *C and M Manufacturing Company,* Eastondale, Massachusetts is now in production on a new precision wire stripper which has been tradenamed "Strip-It."

Designed especially for the electronics industry, the compact new tool fits in tight spots, cuts as well as strips, and provides speedy handling of all wire sizes. The tool will handle both wire and cable.

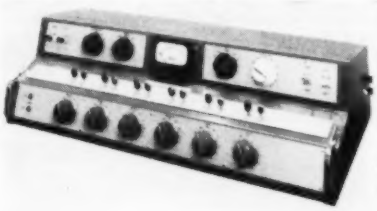
A data sheet giving complete details will be forwarded on request.

AUDIO CONSOLE

A new and compact console which has been designed for two-studio station use and for elaborate p.a. and recording installations has been introduced by *Altec Lansing Corporation* of 9356 Santa Monica Boulevard, Beverly Hills, California.

Known as the 230B, the unit is entirely self-contained and a.c. operated. There are four separate preamplifiers, two booster amplifiers, a line amplifier, and a monitor amplifier, all mounted on a single chassis. Miniature plug-in power supplies for plate and filament supply and for relay and signal light operation are easily removable for servicing or replacement.

The console is equipped with six mixing potentiometers, four of which are connected through switching keys to eight low-level microphone or turntable inputs. The other two are connected with four line inputs, providing a total of twelve inputs, any six of



which may be mixed simultaneously.

Graybar Electric Company, Inc. is handling the distribution of this unit and complete specifications can be obtained from *Graybar* or the company.

H.V. RECTIFIER

Hytron Radio & Electronics Co. of Salem, Massachusetts has introduced a new high voltage rectifier tube, the 1AX2.

In order to overcome the inherent disadvantages encountered in the high voltage rectifiers currently available, the new tube incorporates several features designed to prolong service life. The position of the filament has been changed and is now located in the base of the structure, surrounded by a shield which eliminates bombardment of its cool ends by gas molecules. The filament itself is made more rugged by using a spiral of a special nickel alloy ribbon. The use of this filament wire permits true welding of this filament to its supports. In addition, an insulated tension bar is passed through the center of the coiled filament to limit the amount of movement that can be caused by electrostatic stress.

Specifications on the 1AX2 are now available from the company.

UNGER "TIPLETS"

Unger Electric Tools, Inc., Los Angeles 54, California has introduced two new soldering accessories that are of particular interest to the trade.

The first of the developments is a new, interchangeable thread-in unit which combines the features and advantages of three separate soldering tips. The unit, which has been tradenamed "Elkaloy Tiplets" is actually three soldering tips in one, a trio of individual tips designed to thread into a single heating unit, which in turn, fits into the company's "light-as-a-feather" handle. The new "Elkaloy Tiplets" consist of No. 535 thread-in heating unit, plus the No. 331 pencil "Tiplet," the No. 332 offset "Tiplet," and the No. 333 chisel "Tiplet."

The second development is an increased-wattage thread-in unit which has been especially designed for use with the new "Tiplets." The No. 1235

(*Continued on page* 98)

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BIG VALUE STANDARD COIL TV BOOSTER

★ Latest Model ★ Brand New
★ Reg. List Price $30.00
★ While they last. Model No. B-51.

$10.95 Ea.

Just connect one of these Standard TV boosters to your receiver and get brighter, snappier pictures and less "snow" and interference. Easy to attach. Works on all TV sets. An amazing deal—you can cash in—save money—Order Today. Tunes all 12 channels. Uses a 6AK5 tube and a selenium rectifier. Complete. Operates on 115 V. A.C. Shpg. wt. 6 lbs.

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Latest model. Highly stable. More powerful than old model. Exclusive! New circuit stabilizer-gives maximum stability and picture boost on all 12 TV channels. Incorporates push-pull triode in balanced circuit for high gain. Off-on switch controls both booster and TV set. Perfect tracking accuracy. Improves both picture and sound for real TV enjoyment. Has separate inputs for 72 and 300 ohm lines. Beautiful cabinet. U.L. approved. Complete with 6J6 tube and instructions. Shpg. wt. 81 lbs.

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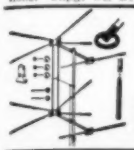

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$8.99 Complete Set

A complete stacked array. Made by a famous manufacturer whose name and brand is on every factory sealed carton. Look what you get: 2 Six-element conical bays, 1 pair "Q" bars, 2 Five-foot mast sections, 60 ft. 300 ohm twin line, 5 Standoff insulators, 1 mounting base, 1 guy ring, 1 clamp, hardware. Elements are highest quality aluminum. Reg. list price is $31.95. Shpg. wt. 15 lbs. Express only.

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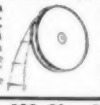
Ideal for fringe area installations. Not affected by moisture or sun. Made of #18 copperweld wire with genuine polystyrene insulators spaced 6" apart. Tensile strength 400 lbs.



Stock No. W-78. 100 ft. coil. Shpg. wt. 4 lbs. ... $4.66

Stock No. W-79. 250 ft. coil. Shpg. wt. 9 lbs. ... $10.95

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Now talk with anyone, anywhere at the mere flick of a button! All electric master station and substation give clear, powerful voice reproduction to rooms or other buildings up to 1000 ft. away. Thousands have been sold for use in restaurants, on farms, offices, stockrooms, factories and in homes. Just plug master station into any 115 V. A.C. electrical outlet—connect 3 wires and you're operating. Modern design. Each unit measures 4½x4½x5½. Equipped with rubber feet and easy slide switches. Handsome appearance—gray crackle finish. High amplification—use 3 tubes. Power output 2½ watts. Regular list price is $37.50. You get the master station, substation and 50 ft. of 9 conductor cable. Complete with tubes. Shpg. wt. 8 lbs.

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Built for RCA. Factory sealed cartons. Worth $45.00 List.

Now you can take advantage of this deal that Olson ran across. Incorporates the latest design to play the records in most demand, 33⅓ and 78. Records may even be intermixed on the spindle. Will hold twelve 10" or ten 12" discs in one loading. Records slide down the center shaft with utmost precision. Low pressure tone arm is equipped with an RCA turn-over cartridge and two permanent needles. Shuts off after last record. Has reject button also. Size 12" x 13". Operates on 115 volts AC, 60 cycles. Shpg. wt. 15 lbs.

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Latest Model—Newest Features

This is not a kit or a tuner. It's a real high-powered AM-FM Radio Chassis that will pull in distant stations with amazing volume and brilliance of tone. Makes a perfect custom installation in existing cabinets, book-cases, walls, etc. Servicemen and Experimenters: Make money installing these for friends and customers.

The circuit is modern and employs 8 tubes (12AT7, 6BE6, 2-6BA6, 6AL5, 6AV6, 6V6 and 5Y3). The entire R. F. assembly and the 4-section tuning condenser is rubber mounted. Tuned R. F. stage plus two I. F. stages give this set terrific FM sensitivity. Separate FM oscillator tube for extreme stability, and triode R. F. and mixer circuits plus radio detector assure noise free, high fidelity FM reception.

Two modern dual knobs control on-off, volume and tone plus AM-FM, phone switch. Equipped with two panel lamps and edge lit dial. Phono input socket and AC receptacle at rear of chassis. Chassis size 13" wide, 7¼" deep, 7¼" high. Cut out in cabinet requires 8x3¼. Output impedance 8 ohms operates on 110-125v AC. 60 cycles. Shpg. wt. 20 lbs. In factory sealed cartons.

COMBINATION DEAL

RADIO AND 12" CO-AXIAL SPEAKER

$49.95 DEAL NO. RA-5268

You get the above Majestic AM-FM Radio chassis exactly as described above PLUS a model S-168 12" Co-axial speaker, 1052 model, as described on opposite page. Both packed in factory sealed cartons.

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RN-752

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U.H.F. Conversion

(*Continued from page 49*)

from the u.h.f. to the v.h.f. ranges and *vice versa*.

A schematic of the u.h.f. oscillator, Fig. 15, illustrates the eight-position method of switching the local oscillator frequency range using incremental coils and condensers. The fixed fundamental frequency can be in the 400 megacycle range and is resonated at this frequency by two small coils in parallel (#16 wire on ¼" form). Higher frequencies are obtained with shunt inductors; lower frequencies with shunt condensers. Frequency deviation is not great and a trimmer range of ± 7 mc. on the fundamental circuit position is sufficient to correct for tube capacity and component dissimilarities.

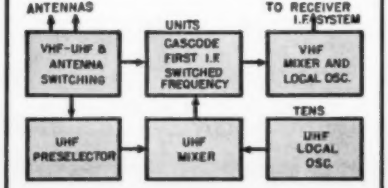
Kingston U.H.F. Tuner

The *Kingston* tuner, Fig. 16, also uses the circular tuned line method though with a greater radius than that employed in the *Mallory* type tuned lines. The antenna is coupled to one end of the mixer-tuned line; the crystal to the other. Consequently, the proper degree of coupling can be obtained at each end without direct interaction as is the case in some designs because of the close proximity of the antenna and mixer circuits. Two trimmers on the preselector line permit tracking adjustments at both ends of the u.h.f. band. A cascode i.f. stage has its output frequency adjusted to the Channel 10-11 frequency range instead of the more common Channel 5-6 range.

Test Equipment Problem

Initially, the alignment of u.h.f. strips and converters will not be difficult. They are basically rather simple units and very little additional test equipment of an elaborate type will be necessary. Test units required will include a signal source, perhaps a source of modulation for that signal, and finally an indicating device. Initially only one or two stations will come on the air in a given area. It is very possible that the station signal and its modulation can be used as a signal source to do the entire u.h.f. section alignment job. Bandwidth is not too trying a problem on the u.h.f. band because six megacycles is small in comparison with the center frequency of hundreds of megacycles. Consequently,

Fig. 13. Block diagram of v.h.f.-u.h.f. tuner.



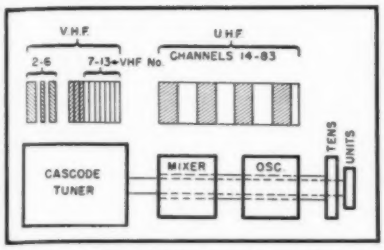


Fig. 14. Channel selection plan used in the Standard Coil v.h.f.-u.h.f. TV tuner unit.

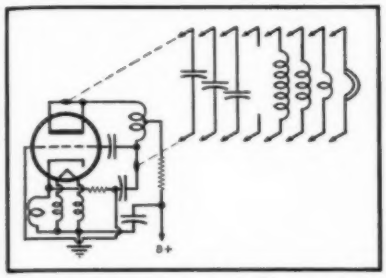


Fig. 15. The u.h.f. local oscillator switching circuit used for the "tens" dial scale.

single-peaked tuned circuits have a six megacycle bandpass; and double-humped characteristics are not necessary. Thus, a simple peaking of the resonant circuits for a maximum is all that is necessary.

Another source of signal can be the harmonic output of your present signal generator (sweep and/or marker). The v.h.f. generators with a high fundamental range have been found to have a high-to-just-usable output on their u.h.f. harmonics. Still a third possibility is to construct a small u.h.f. oscillator to operate on your assigned u.h.f. channel or channels. The oscillator can be calibrated with an accurate wavemeter or harmonic generating crystal-controlled oscillator. Test instrument manufacturers will gradually market u.h.f. sweep signal generators with marker facilities. To summarize, the following signal sources are possibilities—a u.h.f. station, the harmonic output of present v.h.f. generators, a home-constructed u.h.f. oscillator, or a commercial u.h.f. instrument.

It is very possible that a single frequency alignment will suffice for most of the initial u.h.f. converters. Modulation of the signal source is or is not required as a function of the type of indicator used. For single frequency

Table 2. How channels from 40 to 49 fall in with the "tens" dial set on 4. One fixed u.h.f. local oscillator frequency is used (one out of a possible eight).

"Units" Dial	Channel Frequency	Local Osc. Freq.	Cascode I.F. Frequency
0	626-632	470	156-162
1	632-638	470	162-168
2	638-644	470	168-174
3	644-650	470	174-180
4	650-656	470	180-186
5	656-662	470	186-192
6	662-668	470	192-198
7	668-674	470	198-204
8	674-680	470	204-210
9	680-686	470	210-216

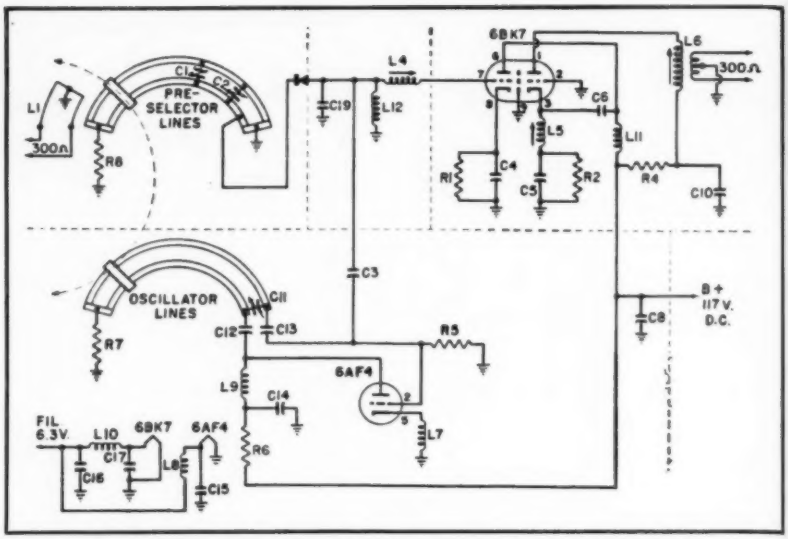


Fig. 16. Circuit diagram of the Kingston Model 5-3 u.h.f. tuner unit.

alignment there are a number of indicator systems, depending on what you have available. Inasmuch as the output of the u.h.f. converter is in the v.h.f. range, an r.f. measuring device can be used.

An excellent indicator is the conventional field strength meter used for v.h.f. signal level measurements. This type of instrument can be attached to the output of a u.h.f. converter, set on correct channel frequency, and serves as a good sensitive peak indicator. It also gives an approximate reading, in microvolts, of the converter output signal voltage.

Some other possibilities are an a.c. vacuum tube voltmeter with r.f. probe and a crystal detector, Fig. 8, with a sensitive current meter. If modulation of the signal source is possible a crystal detector probe and scope can be used. *General Electric* suggests the balanced crystal detector and meter attached to the output of the converter or a v.t.v.m. attached to the output of the video detector in the v.h.f. receiver.

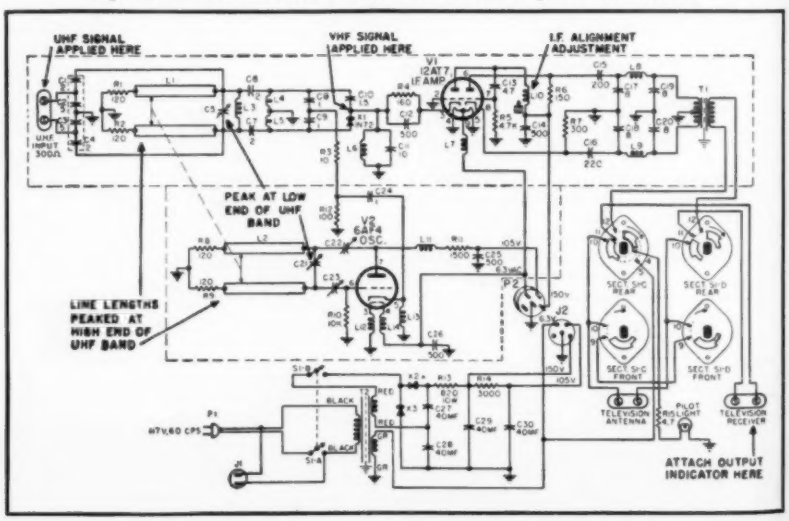
Alignment Trend

Alignment of the first converters and strips will not be difficult. In the alignment of a typical converter, Fig. 17, the i.f. amplifier is first peaked and then the u.h.f. tuned circuits are aligned at the high and low ends of the band.

First a v.h.f. signal generator is applied to the input of the cascode i.f. amplifier and the stage is peaked on the particular v.h.f. channel to be used during u.h.f. reception. Next a source of u.h.f. signal (generator or station signal) is applied to the antenna input and the converter is tuned to the low end of the band where a pair of controls are peaked on the output indicator. Next, the signal source and converter are set to a frequency at the high end and another pair of controls are peaked to complete the alignment.

—30—

Fig. 17. The General Electric u.h.f. converter and alignment connections.



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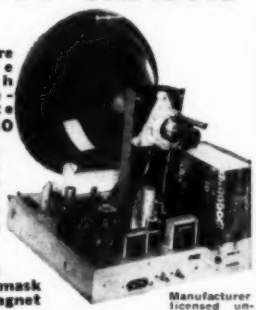
0Z4G		5U4G	.49	6BC5	.59	6L6G	95c	6X4		7Z4		12Z3	.95	46	89c
1A5GT	.65	5V4G	.87	6BC7	.79	6L6GA		6X5GT	49c	12A7	1.15	14A7	.89	47	
1A7	.59	5W4	49c	6BD5GT	.89	6L7	.69	6Y6G	.69	12A8	.59	14AF7	.93	50A5	.89
1B3GT	.69	5W4GT		6BE6	.49	6N6G	1.40	7A4	.59	12AH7	1.45	14B6	89c	50B5	59c
1B5	29c	5X4G	.65	6BF5	.59	6N7GT	69c	7A5	.89	12AT6	.49	14B8		50C5	
1C7G		5Y3GT	.45	6BF6	.59	6P5GT		7A6	73c	12AT7	.89	14C5	1.07	50C6G	1.04
1E7		5Y4G	.54	6BG6G	1.49	6Q7GT	.49	7A7		12AU6	.59	14C7	.98	50L6	.49
1H5GT	.49	5X4G	81c	6BH6	59c	6R7GT	.69	7A8		12AU7	.69	14F7	.89	50X6	.79
1J5GT	.69	5Z3		6BJ6		6S4	.49	7B4		12AV6	.49	14F8	1.30	50Y6	.59
1L4	.59	6A3	1.15	6BN6	.89	6S7GT	1.15	7B5	.73	12AV7	.89	19BG6G	1.49	70L7	.89
1LA4	1.19	6A7	1.21	6BQ6	.89	6S8GT	.69	7B6	.73	12AW6	.95	19T8	.89	71A	.87
1LA6		6A8GT	.59	6BQ7	1.49	6SA7GT	.59	7B7	73	12AX7	.69	20	1.40	75	59c
1LC5	.69	6AB7	1.15	6C4	.49	6SC7	.59	7B8	.73	12BA6	.49	24A	.59	77	
1LC6	1.19	6AC5GT	89c	6C5GT	59c	6SD7GT	.99	7C4	1.30	12BA7	.69	25AC5GT	1.04	78	1.10
1LD5	.95	6AC7		6C6		6SF5	.49	7C5	73c	12BE6	49c	25BQ6GT	1.15	80	.45
1LE5	1.19	6AG5	.69	6C8G	1.15	6SF5GT	.49	7C6		12BF6		25L6GT	.49	83	1.45
1LH4	1.19	6AG7	.89	6CB6	.59	6SH7	.59	7C7		12BH7	.69	25W4GT	.59	85	.79
1LN5	1.19	6AH6	1.40	6CD6G	1.49	6SH7GT	.59	7E6	.59	12C8	1.15	25X5	1.04	117L7	1.40
1N5GT	.59	6AK5	.89	6D6	.59	6SJ7	49c	7E7	.69	12F5GT		25Z6GT	.59	117N7	.89
1P5GT	69c	6AK6	1.08	6D8G	1.15	6SJ7GT		7F7	.89	12H6	65c	32L7GT	1.15	117P7	1.40
1Q5GT		6AL5	59c	6E5	.59	6SK7GT	.59	7F8	1.47	12J5GT	.54	35A5	.99	117Z3	.49
1R5	59c	6AQ5		6F5GT	49c	6SL7GT	.69	7G7	.69	12K7GT	.59	35B5	59c	117Z6	.69
1S5		6AQ6	.81	6F6GT		6SN7GT	.59	7H7	.59	12Q7GT	.49	35C5		807	1.55
1T4		6AR5	.74	6F8G	1.15	6SQ7	49c	7J7	.69	12SA7GT	.59	35L6	.49	813	8.95
1U4		6AT6	.49	6G6G	.95	6SQ7GT		7K7	1.07	12SC7	59	35W4	.45	1294	29c
1U5	.49	6AS5	.90	6H6GT	.49	6SR7GT	.49	7L7	.69	12SF5GT	59c	35Y4	99c	1299	
1X2A	.69	6AU5GT	.69	6J5GT	.49	6SS7	.72	7N7	59c	12SF7		35Z3	.49	1619	.45
2A3	1.15	6AU6	49c	6J6	1.04	6T7G	1.15	7Q7		12SH7GT	.59	35Z4	.45	1629	.29
2A5	.79	6AV6		6J7G	.59	6T8	.89	7R7	.89	16SJ7GT	.49	35Z5	.95	2050	2.00
2LF4	1.19	6B4G	1.44	6J8G	1.15	6U5	.59	7S7	1.07	12SK7GT	.59	35Z6G	.79	2051	1.15
3Q4	.59	6B5		6K5GT	.69	6U6GT	59c	7V7	.69	12SL7GT	.69	35/51	.72	7193	.87
3Q5GT	1.08	6B6G	.79	6K6GT	.49	6U7G		7W7	1.07	12SN7GT	.99	41	.59	VT51	29c
3S4	59c	6B8GT	1.15	6K7GT	.59	6V6GT	.59	7X6	.89	12SQ7	49c	42		VT52	
3V4		6BA6	.49	6K8GT	.69			7X7	.69	12SQ7GT		43	72c		
												45			

Finest TV CHASSIS

Complete with **TUBE!**

12½" picture tube with complete chassis . . . **$79.50**

16" picture tube with complete chassis . . . **$99.50**



Manufacturer licensed under RCA patents.

INCLUDES:
- beautiful bronze metal mask
- permanent magnet 12" speaker
- all tubes aligned perfectly
- ideal for fringe areas . . . works better than other receivers and where others can't
- ultra-sensitive fringe area tuner
- standard 90-day guarantee on all tubes and parts
- full band reception and output
- gated AGC—finest automatic gain control
- COMPLETE . . . READY TO OPERATE

OUTPUT TRANSFORMERS

Standard Replacement
For 50L6, 35L6, 50A5, 35A5, 117L7 . . **39c** ea.
For 6V6, 6F6, 3Q5, 3Q4, 3S4, 3V4, 41, 42, 6K6, 2A3, 45, 6L6 . . **49c** ea.
Universal Output Transformer Special
Up to 12 watts to any speaker . . **79c** ea.
(While They Last)

CHIMNEY MOUNTS

for TV Antenna . . . **98c** each

TUBE KITS

BEST BRANDS AT BEST PRICES

3Q4, 1T4, 1R5, 1S5. List Value $8.80. Tube Kit only . . . **$1.98**
3S4, 1T4, 1S5, 1R5. List Value $7.80. 4 Tube Kit . . . **$1.98**
1U4, 3S4, 1S5, 1R5. List Value $7.80. All Four Tubes for . . . **$1.98**
3V4, 1R5, 1S5, 1T4. List Value $7.80. All for . . . **$1.98**
117Z3, 1U5, 3V4, 1R5, 1T4. AC-DC Portable Kit. All for . . . **$2.49**
12AT6, 12BA6, 12BE6, 35W4, 50B5. 5 Tubes for . . . **$2.59**
50L6GT 3,5Z5GT, 12SQ7GT, 12SK7G, 12SA7G. 5 Tubes for . . . **$3.22**

Fringe Area DOUBLE "V" TV ANTENNA KIT

High Gain, Best Pictures Possible!. . . complete with 300 ohm line, insulators, guy wire, hardware, full size antenna with double length 9 ft. mast . . . $6.95 complete

TV PICTURE TUBES

Six month guarantee

10BP4	$12.95	16GP4	$23.95
12LP4	$16.95	16JP4	$29.95
12LP4A	$16.95	16RP4	$18.95
14BP4	$22.95	16TP4	$18.95
7JP4	$15.95	17BP4A	$24.95
16AP4	$22.95	19AP4A	$27.95
16BP4	$23.95	19AP4B	$27.95

PILOT LIGHT SPECIAL

No. 47—Box of 100 for only . . **$2.95**
Box of ten for . . . **39c**
3 speed G. I. CHANGER complete, ready to install . . . **$24.95**

TWIN LEAD

300 ohm twin lead 55 Web virgin polyethylene, in either clear or brown, the finest available.
1000 ft. $18.50 | 100 ft. $1.95

6 FOOT LINE CORD

UL apprvd. cord and plug—10 for $1.95
TV Tubular Capacitor .05 mfd, 6000-VDC Only . . . 79c ea.

Get our special sales bulletins . . . write TODAY!

P. M. SPEAKERS

12" Coaxial PM Speakers . . . **$12.95** ea.
High fidelity with high pass filter attached. 20 watt; 40-17500 cps. response; 8 ohm VC.
Very best quality—NATIONAL BRANDS Individually Packed

3"	$1.26 ea.	8"	$3.23 ea.
4"	1.36	10"	5.10
5"	1.59	12"	6.54
6"	Special Price		$1.59 ea.

RESISTOR KITS

Insulated ½, 1 and 2 watt assortment of most used values, best brands. 100 for **$2.95**

TERMS: 20% DEPOSIT with order, balance C. O. D. All shipments F. O. B. Chicago.
FREE DELIVERY on all orders of $10.00 or more. Insurance and shipping charges prepaid anywhere in Continental U. S.

PREMIER Radio Tube Division

CONTINENTAL CORPORATION

551 W. Randolph St.
Chicago 6, Illinois
ANdover 3-1590

RADIO-TV Service Industry News

AS REPORTED BY THE TELEVISION TECHNICIANS LECTURE BUREAU

THE constant scourge of the radio-television servicing industry is the misuse of labor charges in the hopes of selling more service jobs—or more sets. Although the cost of competent technical labor is fixed by competitive and economic factors beyond the control of any individual businessman or group of businessmen, there seems to be a continuing stream of men who, through design or ignorance, think they can outsmart their competition by offering labor at below cost prices as a sales gimmick. This is especially true of television because the set owning public has yet to learn through costly experience that competent, efficient, reliable service cannot be "cheap" service. As the general public gains more actual experience with service on their TV receivers they will learn to recognize the "sucker" ads that use cheap labor as a "bait" and only the most gullible of them will bite. This process of public education on what to expect from and to pay for efficient television service can be accelerated, and made less costly to the public, by the combined efforts of all elements of the industry in disseminating factual information about the requirements for good service.

Three Trouble-Makers

The three major offenders in the manipulation of service charges, and in cheating, that stem from the use of low labor charges as a sales gimmick are: (1) The racketeers and chiselers who purposely use substandard labor charges as a lever to get service jobs on which they can levy unconscionable charges for parts; (2) Manufacturers or dealers who, in trying to create a demand for weak sister sets, make labor commitments beyond the customary and accepted standard manufacturer's warranty period: and (3) The service operator or technician who has no concept or understanding of his economic obligations or knows the actual costs of doing business and who usually prices his work on the basis of his immediate need for a few dollars.

Of these three the service racketeer is the worst offender in bilking the public and in bringing discredit to the entire servicing industry. However, his activities become known rather quickly through complaints to the local Better Business Bureau and other agencies. In cities where a strong association of ethically operated service businesses is functioning, the racketeers can be brought to justice and their depredations eliminated through the combined efforts of the interested agencies of legitimate business.

TISA of Chicago

For a long time the city of Chicago had been comparatively free from fast dollar operators on television service. Early this year, however, a number of new "TV Service Companies" started operations there offering service calls for $3.00. On the heels of these offers there followed a growing number of complaints from set owners about having to pay up to $85.00 in service charges to get their sets returned.

This situation became of major concern to the Television Installation Service Association (TISA) of Chicago. The Association set up a special Fraud Investigating Committee to study the activities of these low-priced service advertisers. The results achieved by TISA through the work of this committee were reported recently by Frank Moch, president of the Association:

"TISA has instituted a comprehensive investigation of TV service racketeers who have suddenly invaded the Chicago area. The first target is the $3.00 service call. It should be obvious to any that such offers are only schemes. In this scheme, entry is gained to the home by offering to do service for $3.00, daytime, nighttime, Sundays, and holidays. The alleged technician who calls, generally an incompetent student, attempts to pull every set into a highly questionable shop. Estimate requests and other usual procedures are ignored. Set owners are then required to 'ransom' sets for fees as high as $85.00. No itemized bills are issued and defective parts never returned. If the owner won't permit the set to leave his home the would-be technician charges the customer with as many as six tubes, very few of which are actually used. Even a needed tube is seldom new.

Checks are never accepted and no records are kept.

"TISA obtained hundreds of sworn statements from bilked set owners and from past and present employees of the companies involved. Sets were set-up with very obvious, natural type defects. Every step of these set-ups was witnessed and sworn to by the owners and qualified, competent experts. These sets were submitted for service to suspected companies. The results confirmed the reports of set owners. The Chicago Better Business Bureau, some newspapers, and the State Attorney's office cooperated fully. A special investigator and special prosecutors were assigned to the case. The first of the companies was subpoenaed to appear before the Cook County Grand Jury. The investigation is proceeding on schedule. As a result of the investigation, four companies have closed their doors and ceased operations. Other offenders will be brought to trial as soon as the first case is disposed of. A permanent Grievance Committee is now functioning to continuously police service operations."

TSA of Detroit

The Television Service Association of Michigan, Inc., has been carrying out an aggressive program to clean up the television service industry in Detroit. Working with the Better Business Bureau, the OPS, and the prosecutor's office the Association has been successful in ousting some bad actors from the newspapers and in getting two convictions for fraud.

TSA has been successful in building up a growing interest in active service association participation among service businessmen throughout the State of Michigan. More than 1300 people attended the two management meetings which they recently sponsored. To enable technicians to gather a great deal of important technical information in a short period of time, TSA has been sponsoring two-day service clinics. They have received excellent cooperation from local set distributors each of whom displays latest chassis with competent distributor or factory service personnel in attendance to answer questions on design, adjustments, or servicing.

Service as a Gimmick

Fortunately, most manufacturers realize that the key to consistently good TV viewing is reliable, efficient service. There is a feeling, too, that the average TV set owner will be more "brand conscious" when he buys a new TV set than he was at the time he bought his first one. The quality and character of service he was able to get on his first set will greatly influence his choice when he makes a change.

However, there are still a few manufacturers who, in trying to sell slow-moving sets, have been picking on service as the gimmick to interest buyers. Ads recently appeared in some areas offering "Lifetime service at the cost of the regular 90-day warranty service" and claiming that buyers

would have "No Labor Charges (to pay)—Ever." Of course, if the buyer of such a set carefully reads the guarantee he is given he will find that what he is given "for free" will be only a small part of what he will be charged for service calls on the set.

The unfortunate effect that such advertising claims tend to produce is to further distort the general opinion among set owners that TV service is over-priced. Good service cannot be cheap or "free service". Public opinion must be up-graded in the facts of television service and what it costs to render the kind of service good TV viewing needs and deserves. A recent TISA bulletin pin-pointed the facts of service that must be gotten across to the set-owning public:

"If TV set owners would but realize that TV service, because of its complexity, requires the services of highly trained technicians with years of schooling and experience and that men of this caliber command a wage of $2.00 to $2.50 and more per hour, they will begin to learn that service cannot be cheap. Further, traveling cost to get to the home amounts to another 50 cents minimum and when you add to this the cost of extensive insurance coverage, taxes, office expense, expensive test equipment, tools, technical data, rent, light, heat, it is obvious that no one can perform a service call for $3.00. Actually, a nation-wide, authentic survey reveals that the actual expenses of service are such that a call must cost the customer somewhere between $5.00 and $6.00 for service alone."

Consumer Booklets

The Association of Better Business Bureaus and the Radio-Television Manufacturers Association recently announced their joint sponsorship of a booklet providing basic information necessary for purchasers or owners of television receivers.

The new 11-page booklet is a revised edition of a booklet which originally was issued by the Better Business Bureau of New York City. The revised edition, "Things You Should Know About the Purchase and Servicing of Television Sets," was prepared by the RTMA Service Committee in cooperation with the Television Service Committee of the Association of Better Business Bureaus.

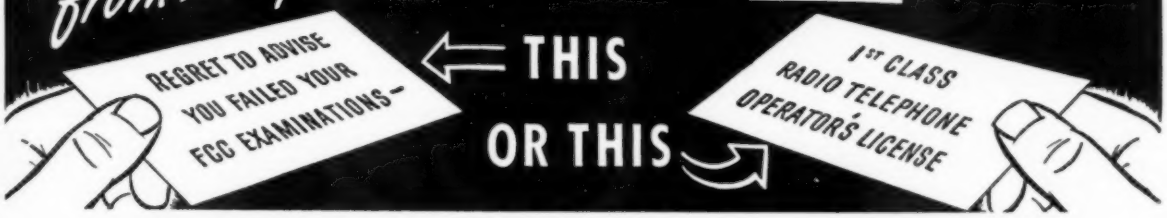
Issued as a public service by the two organizations, the booklet is designed to point out problems which may arise in the purchase and operation of a TV receiver.

Copies of the BBB-RTMA booklet may be obtained through the Better Business Bureaus.

ARTSD of Columbus

The Associated Radio & Television Service Dealers of Columbus, Ohio, has launched a campaign to make clearance by the Better Business Bureau a prerequisite for display advertising in the yellow directory of the telephone book. Pointing out that the

Six Months from Today Which will YOU hold?



ADD TECHNICAL TRAINING TO YOUR PRACTICAL EXPERIENCE

GET YOUR FCC LICENSE IN A HURRY!

Then use our Amazingly Effective JOB-*FINDING* SERVICE

Get this Valuable Booklet FREE

TELLS HOW YOU CAN GET A FREE TELEVISION ENGINEERING COURSE

TELLS HOW—

WE GUARANTEE

TO TRAIN AND COACH YOU AT HOME IN SPARE TIME UNTIL YOU GET

YOUR FCC LICENSE

If you have had any practical experience—Amateur, Army, Navy, radio repair, or experimenting.

TELLS HOW— **Employers make**

JOB OFFERS Like These to Our Graduates Every Month

Letter from Chief Engineer, Broadcast Station, North Carolina, "Need men with radio-telephone 1st class licenses, no experience necessary. Will learn more than at average station for we are equipped with Diesel Electric power, transmitting and studio equipment."

Telegram from Chief Engineer, Broadcast Station, Wyoming. "Please send latest list available first class operators. Have November 10th opening for two combo men."

These are just a few samples of the job offers that come to our office periodically. Some licensed radioman filled each of these jobs . . . it might have been you!

HERE'S PROOF FCC LICENSES ARE OFTEN SECURED IN A FEW HOURS OF STUDY With OUR Coaching AT HOME in Spare Time.

Name and Address	License	Lessons
Lee Worthy, 2210½ Wilshire St., Bakersfield, California	2nd Phone	16
Clifford E. Vogt, Box 1016, Dania, Florida	1st Phone	20
Francis X. Foerch, 38 Boucier Pl., Bergenfield, New Jersey	1st Phone	38
S.Sgt. Ben M. Davis, 317 North Roosevelt, Lebanon, Illinois	1st Phone	38
Albert Schoell, 110 West 11th St., Escondido, California	2nd Phone	23

CLEVELAND INSTITUTE OF RADIO ELECTRONICS
SMITH, E. E., Consulting Engineer, President
Desk RN-43, 4900 Euclid Bldg., Cleveland 3, Ohio

TELLS HOW—

Our Amazingly Effective JOB-FINDING SERVICE Helps CIRE Students Get Better Jobs

Here are a few recent examples of Job-Finding results:

GETS CIVIL SERVICE JOB

"Thanks to your course I obtained my 2nd phone license, and am now employed by Civil Service at Great Lakes Naval Training Station as an Equipment Specialist."
Kenneth R. Leiser, Fair Oaks, Mtd. Del., McHenry, Ill.

GETS STATE POLICE JOB

"I have obtained my 1st class ticket (thanks to your school) and since receiving same I have held good jobs at all times. I am now Chief Radio Operator with the Kentucky State Police."
Edwin P. Healy, 264 E. 3rd St., London, Ky.

GETS BROADCAST JOB

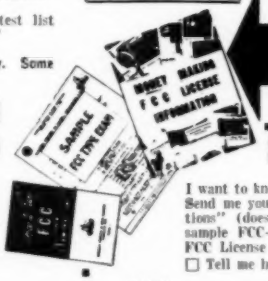
"I wish to thank your Job-Finding Service for the help in securing for me the position of transmitter operator here at WCAE, in Pittsburgh."
Walter Koschik, 1442 Ridge Ave., N. Braddock, Pa.

OURS IS THE ONLY HOME STUDY COURSE WHICH SUPPLIES FCC-TYPE EXAMINATIONS WITH ALL LESSONS AND FINAL TESTS.

GETS AIRLINES JOB

"Due to your Job-Finding Service, I have been getting many offers from all over the country, and I have taken a job with Capital Airlines in Chicago, as a Radio Mechanic."
Harry Clare, 4537 S. Drexel Blvd., Chicago, Ill.

Your FCC Ticket is recognized in all radio fields as proof of your technical ability



Get All 3 FREE

MAIL COUPON NOW

CLEVELAND INSTITUTE OF RADIO ELECTRONICS
Desk RN-43—4900 Euclid Bldg., Cleveland 3, Ohio
(Address to Desk No. to avoid delay)

I want to know how I can get my FCC ticket in a minimum of time. Send me your FREE booklet, "How to Pass FCC License Examinations" (does not cover exams for Amateur License), as well as a sample FCC-type exam and the valuable booklet, "Money-Making FCC License Information."

☐ Tell me how I can get your Free Television Course.

NAME .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

Paste on two-cent postcard or send air mail

public has been pretty well sold on the idea of "shopping through the yellow pages of the telephone directory," Fred Colton, president of ARTSD, said "the telephone company has created a prestige position for the advertisers in the telephone directories. We felt that they, too, should be very much interested in keeping racketeers out of the business and, since television is still so new and mysterious to the people who own sets, service companies that are granted the right to use display advertising space should be known to be reliable and capable of giving dependable, efficient TV service."

The Columbus association has made its emblem of Certified Service widely known throughout the city for the best in TV installation and service. They have had excellent cooperation from the Columbus newspapers and they work closely with the Better Business Bureau. The pay-off is that more and more Columbus set owners inquire when they call a company for TV service, "Are you certified?"

NARDA Booklet

Another useful booklet prepared for consumer education on TV operation and service was recently announced by the National Appliance & Radio-TV Dealers Association. This 8-page pamphlet was written by Mort Farr, president of NARDA, and one of the best informed dealers in the industry on service business operation and problems.

The booklet covers the most common TV sore spots with consumers, such as: Television Is Not Normally Trouble-Free; Ghosts Do Not Denote Defects; Ghost Problem Can be Solved; Indoor Antennas are Second Best; Diagnosis May Be Difficult; etc.

Information about the NARDA booklet may be obtained by writing to: The National Appliance & Radio-TV Dealers Association, Suite 1141, Merchandise Mart, Chicago 54, Ill.

Service Business at a Profit

The successful management of even the smallest kind of a business today is a complex activity. Our relatively small businesses that have evolved to handle TV installation and service place the entire responsibility for all phases of management on the shoulders of one or two men. To manage these businesses successfully these men must possess unusual talents and abilities. They must be versatile and ingenious and comprehend the technical as well as the business operating phases of this business. In addition to the many operational and technical problems that must be handled they must preserve the substantial investment that had to be made to provide the facilities for giving competent, reliable service. To preserve that investment the business *must* be operated at a profit.

The remarks made by Mr. A. W. Robertson, finance committee chairman and director of the *Westinghouse Electric Corporation,* in a recent speech on the "Role of 'Profit Makers' in the Nation's Economy," deserve careful study by every man engaged in managing any type of a business—and particularly those in the business of servicing radio and television receivers:

Mr. Robertson described profits as the "incentive which justifies and encourages men to take the trouble to improve conditions of their fellow men. Without profits poor men, no matter how able, could never improve their position, could never bring something worthwhile to the attention of the public.

"Henry Ford once was a poor man with an idea. His idea was to make an automobile so simple and so cheap that it would be within the reach of all men. He didn't have money with which to attain his goal, but out of the profits of his early ventures he succeeded in starting the mighty *Ford Motor Company* which did place cheap automobiles within the reach of almost all of us.

"The true significance of the right of an individual to enter into an enterprise for profit is being lost sight of. By some mysterious method, the very word *profit* has taken on a sinister aspect to the extent that one of the worst things that anyone can be called is a 'profiteer.'

"Businesses that operate at a profit don't simply spring out of the ground like an oak from an acorn or goldenrod from seed. It takes hope, ambition, ingenuity, courage, foresight, and the use of thousands of materials and thousands of skills—all coordinated to a common end—to produce something which people, known as customers, may like well enough to buy at a price which results in a profit after all expenses are paid.

"It isn't easy to plan, supervise, and operate a business for profit. Those who can do so are obviously able and fortunate. But they also are benefactors of the human race because they must necessarily have pleased customers or they would not have sold their product.

"Business for profit is a game which may need a referee to keep contestants within the rules, but it is in no sense an evil, anti-social activity."

Operational Costs

The Pittsburgh TSA Newsletter recently carried the following itemized list of the factors of cost that enter into the operation of an efficient TV Service Business:

"Below are listed many of the costs, seen and unseen, which should go into the charges for television service. When they are considered it is remarkable that the reasonable charges of capable and responsible service operators can be kept at such low levels as they are today. Every television owner ought to have this picture of costs every time he considers a TV service bill:

"Rent, heat, light; Telephones; Wages of non-productive employees; Technical books and magazines; Wages of

PLATT B-R-A-N-C-H-E-S OUT...

OPENS NEW DOWNTOWN STORE!!

For the convenience of his many customers who like to shop in person, PLATT has opened a brand new branch store at 159 GREENWICH STREET, N. Y. C. (Mail Orders are to continue going to the main store and warehouse at 489 Broome St., N. Y. C.)

The new PLATT Store is easily reached by the B.M.T., I.R.T., Hudson Tubes, and Independent Line. So why not visit PLATT's Bargain Store today? You'll find many additional values that space does not allow us to list here.

SPECIAL SALE TO CELEBRATE OPENING!

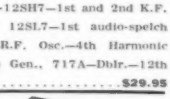
TUBES — BRAND NEW! JAN! BOXED! — TUBES

826	39c	1629	22c	2C26A	9c
1625	29c	7193	19c	3D6	39c
VT-127	15c	801A	19c	15R	39c
3C24	98c	841	29c	39/44	29c
RK34	99c	864	19c	215A	9c
304TH	$5.95	872A	49c	722A	99c
1616	49c	954	13c	316A	29c
1619	19c	E1148	49c	9006	19c
1626	19c	2C26	9c	9002	69c

ARC-5/R-28 2 MTR RCVR $29.95

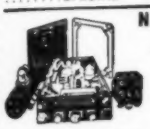
Here is the 2-meter superhet you have been looking for! Absolutely one of the BEST available today! Tunes from 100 to 156 Mcs. in four crystal channels. Easily converted to continuous tuning. Tube lineup is as follows: 717A—R.F., 717A—Mixer, 2-12SH7—1st and 2nd K.F. 16.9 Mc. 12SL7—Det, AVC Squelch, 12SL7—1st audio-speech amplifier. 12A6—2nd audio. 12SH7—R.F. Osc.—4th Harmonic Gen. 717A—Trip. 12th Harmonic Gen., 717A—Dblr.—12th Harmonic. Excellent, used $29.95

TURBO AMPLIFIER



4 tube Amplifier used by U. S. Air Force. 115 V. input at 400 cycles. Without tubes—BRAND NEW ..... SPECIAL $1.19

NEW SUPPLY ARRIVED! LIMITED QUANTITY TRANSMITTER-RECEIVER



Navy Model ABA-1 (CG-43AAG)
Army Model SCR-515A, known as the BC-645
450 MC — 15 Tubes
BRAND NEW—ORIGINAL CARTON

Can be easily converted for phone or CW 2-way communication. Covering for the following bands: 420-450 MC ham band, 450-460 MC for fixed or mobile, 460-470 MC for citizens, 470-500 MC television experimental. Size 10½ x 13½ x 4¾. Contains 15 tubes: 4—7F7, 4—7H7, 2—7E6, 2—6F6, 2—955, 1—WE-316A door knob. Price includes Dynamotor, Control Box, Mount, Tubes $34.95
Complete set of spare parts, tubes and plugs for above $22.95

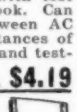
MN-26Y INSTALLATION

MN-26Y Receiver—Remote control commercial type navigational. Indicates direction of any desired transmitting station. Frequency range: 150 to 325 KC, 325 to 695 KC, 3.4 to 7 megacycles in 3 bands. Has 12—6V type tubes. GOOD, used (Original Cost $600). YOUR PRICE ONLY $24.95

ARMY TEST UNIT 1-236

Meter is contained in a metal box 5½" long x 3¾" wide x 3¼" deep. Comes complete with test leads and instruction book. Can be used for testing between AC and DC measuring resistances of circuits, checking fuses and testing capacitors. SPECIAL $4.19

Multitester Foundation BIAS METER 1-97A



Contains a zero center 3½" round Marion voltmeter calibrated 0-100 volts each side. Movement is one mill each side of center. The unit is mounted in a steel box 7" x 5" x 4½" and contains 8 contact push button, line cord dual 100 MFD at 200 V DC condenser, a potentiometer 6 IRC 1% wire wound non-inductive resistors: one 400 ohm, two 2500 ohm, one 5000 ohm, one 10,000 ohm, one 15,000 ohm. Excellent for building a zero center multitester with ranges of 1, 10, 100, 1000 volts.
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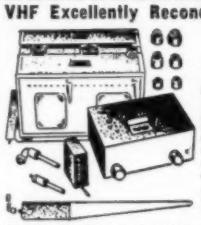

SCR-522 AIRBORNE COMMAND EQUIPMENT

Frequency Range 100 to 156 mcs. in 4 channels receiver and transmitter. Crystal controlled. Complete equipment. Consists of trans/rec, control box BC-602, dynamotor PE-94, AN104A antenna, plugs, etc. Power input with PE-94 is 28 v.

Electrically Tested—Complete as Shown. Only $129.50
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BC-221 Frequency Meter

Real Value! QUANTITY IS LIMITED—so first come, first served. They are just like new, with original calibration charts. Range 125-20,000 KC with crystal check points in all ranges. Complete with crystal and tubes $129.50
MODULATED TYPE $159.50
MODULATED TYPE WITH AC POWER SUPPLY 179.50
These Frequency Meters are factory tested, checked for frequency alignment and GUARANTEED.

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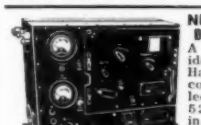
The K-1 is used to amplify output level for microphones and phonographs. Operates on 24-28 VDC, can be converted to 110 AC. Comes complete with PL 55 plug and 2-foot 119-B cord. 2 terminal blocks and instruction book. BRAND NEW ..... SPECIAL! $3.95

NEW! SHIP-TO-SHORE BC-223 TRANSMITTER



A 30 watt Transmitter, ideal for ship-to-shore or Ham Rig. Crystal or MO control on four pre-selected channels. 2000 to 5250 KC. Use of 3 plug-in coils, five tubes: 2—801 and 3—46, and TU 17-18-25 tuning units.

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TUBES	6.95
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PE-125 POWER SUPPLY for BC-223—12 or 24V input; output 475V 150 ma—BRAND NEW	20.95
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CABLE between TRANSMITTER and POWER SUPPLY—NEW	3.95

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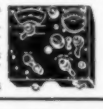
CD-307A Cords, 6 ft. NEW	.89
H-16/U high impedance. Includes two receiving units	3.95
HS-16 high impedance—used	2.49

Control Box BC-434-A



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BC-455—6 to 9 MC	9.95	11.95	$16.95
TRANSMITTERS			
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BC-458—5.3 to 7 MC	7.95	9.95	17.95
ARC5-T-19—3 to 4 MC		24.95	34.95
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BC-456 Modulator	2.49	2.95	5.95
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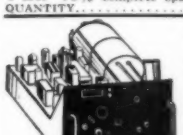

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Radar Set AN/APT-5 operates on 80 or 115 volts A.C. at 400 to 2600 cycles requiring 640 volts amperes at 0.90 power factor. Complete with all tubes. Brand new in original packing. $149.50
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–30–

International Short-Wave

(*Continued from page 58*)

Belgian Congo—Radio Leo, Leopoldville, is scheduled Sundays *only* 0300-0500 on 11.270, 15.170, with 5 kw.; all-French. (WRH) OTM2, 9.380A, noted 0300 with French session of news, music. (Sanderson, Australia) Heard in Texas 1530 at fair level with slight QRM. (Hoelscher) OTC2, 9.767, is strong signal during news 2130. (Lund, Iowa)

Brazil—Radio Jornal do Commercio, 11.825, noted around 1830-2120A sign-off; identifies in both Portuguese and *English.* (Niblack, Ind.) Heard in N. Y. at good level 1900. (Mast) PRL7, 9.72, Rio de Janeiro, noted 2145 with music. (Hoffman, N. Y.) *Radio Tamandare,* Recife, Pernambuco, of Emissoras Associadas, lists ZYK21 on 3.265 with 1 kw. (Catch, England) PRB22, 9.505, *Radio Record,* Sao Paulo, noted 2022 heterodyning XEWW, Mexico City, 9.500. (Harris, Calif.) ZYB5, 4.935, Natal, is heard well early evenings (*EST*). (Robbins, Ind.) PRL4, 9.770, is now inactive; instead, PRL5, 11.950, is used 0450-0700, 1000-2130. (WRH)

British Honduras—WRH says *Radio Belize* is operating on 4.950 with 0.2 kw. at 1315-1400, 2000-2100, with news 1330 and 2015. *Not confirmed.*

British New Guinea — VLT7, 7.28, Pt. Moresby, noted to 0745 sign-off. (Stark, Texas)

Bulgaria—Radio Sofia, 7.671A, noted with news 1600. (Sanderson, Australia; O'Sullivan, England) Should also have *English* 1500.

Canada—VED, 7.320, Edmonton, Alberta, logged 2055-2130; suffers from severe CWQRM. (Patterson, Ga.) QSL from CBNX, St. John's, Newfoundland, listed schedule of 0530-2200 on 5.970, 300 watts. (Golden, Mass.)

Canary Islands — EA8AB, 7.518A, *Radio Clube de Tenerife,* noted with music 1700. (O'Sullivan, England)

Ceylon—Radio Ceylon logged on 17.820 at 0545. (Sanderson, Australia) Heard on 11.975 with BBC news relay 1100 and signed off 1146 with "Strike Up the Band." (Black, Pa.)

Chile—CE960, 9.593A, noted recently around 1915 with Latin American tunes; man announcer in Spanish; fair level, no QRM, but some fading. (Bellington, N. Y.) WRH lists this one now as on 9.192 daily 1030-2200.

China — Radio Peking noted on 15.060V with *English* 0400 and announcing 6.100, 11.690, 10.260, 15.170 as parallel; said next *English* would be 0830 on 11.690, 15.060, and at 1730 on 11.690, 15.060. (Pearce, England) Heard mornings (*EST*) on 6.100. (Stein, Calif.)

Colombia—HJEX, 6.054, Cali, *Radio Pacifico,* noted signing off 2300. (Baitzel, N. J.) HJDE, 6.145, has fair level from 2100 tune-in to 2400 sign-off. (Saylor, Va.) HJBB, 4.815, Cucuta, noted 1920 with Latin American music, fair level in Britain. (Catch) HJCQ, 4.955, noted signing off 2400 with National Anthem. (del Pozo G., Cuba)

Costa Rica—Radio Athenea, 11.972A, good level in Cuba 1010-1230. (del Pozo G.) Lately has been lower—around 11.965. (Stark, Texas)

Cuba—COCY, 6.450, Havana, noted 1930 at rather weak level in England. (Catch) COBH is currently on *measured* 11.796; previous measurement was 11.800. (Oskay, N. J.)

Curacao—Willemstad, 5.014A, has *English* on Wednesdays 2000-2030. (Kolberson, N. J.)

Czechoslovakia—Prague, 9.55, noted in *English* to North America 1930-2000. (Niblack, Ind.; Mast, N. Y., others) Heard again on 11.760 with Russian 0400; Swedish is now radiated on 9.505 at 1330-1400. (Radio Sweden) Still has news 1400 on 9.505; on 11.840 at 0715. (Pearce, England) Noted closing *English* period 1422 on 9.505 and had announcement of "The Voice of Peace;" said further *English* would be at 1600. (Hoffman, N. Y.)

Denmark — Copenhagen now uses 9.52 instead of 7.26 for the broadcast to the Faroe Islands. (ISWC, London) Noted on 15.180 with news 0845. (Saylor, Va.)

Dominican Republic—HI9B, 4.917A, noted around 2000. (Stark, Texas, others)

Ecuador — HCJB, Quito, recently changed its 31-m. channel from 9.970A to 9.745A; heard some days as late as 0245. (Bellington, Kroll, N. Y., others) Guentzler, Ohio, says announces new channel as 9.745; *measured* by Oskay, N. J., as 9.7435 at 0640. Mast, N. Y., notes the 17.890 channel signing off 1730. Oskay, N. J., recently *measured* HC2RL, 6.632, noted on a Tuesday 2135 (only day scheduled).

Egypt—Cairo, 9.715, still signs on 1345; has news 1400; runs to 1700. (Pearce, England) SUX, 7.865, Cairo, peaks at fair level around 1505 (in Arabic). (Kary, Pa.)

Ethiopia—Radio Addis Ababa, 15.047A, still signs on in Amharic 1130; usually closes now 1305 after news in native; *no English heard of late.* (Pearce, England) Heard in N. C. leaving the air 1342 at fair level. (Ferguson)

Fiji Islands—According to the N. Z. DX Times, Fiji will not begin opera-

tions of its projected transmitter until *early* 1953 and will operate on 6.135, 9.535. (Bellington, N. Y.)

Finland—Helsinki still noted with news 0715 on 17.800, 15.190. (Fried, Mich.)

France—Paris heard signing off 1030 with "La Marseillaise" on 15.400 after French session. (Pearce, England) Noted signing on 1830 with "La Marseillaise" on 9.620A and continuing with French program, strong level. (Robertson, Mass.) The 11.700 channel noted in parallel. (Bellington, N. Y.) Paris, 7.105, heard to 1556 sign-off after relay of Home Service. (Kary, Pa.)

French West Africa—Radio Dakar, 11.896A, noted with recordings 0215; news in French 0230. (Pearce, England) Noted with news in French 1500, 1700. (Kary, Pa.)

Germany — Hamburg, 6.270, noted around 0225-0500 or later; news in German 0300. (Pearce, England) Received attractive QSL from Frankfort, Hessischer Rundfunk, listed 48.47 m. (Golden, Mass.)

Greece—Radio Athens is now scheduled on 7.300 at 2330-0300, 1030-1400, 1530-1700 to the Balkans and the Near East; on 9.607 at 2000-2100 to USA-Canada (news 2035A), at 0430-0830 to Balkans and the Near East, 1430-1500 to Western Europe (news 1430). (WRH) Larissa, 6.745, noted recently 0115. (Pearce, England)

Greenland — OXI, 7.094, Godthaab, noted 1740 with talk in Icelandic; at 1750 began orchestral recordings. (Pearce, England)

Guatemala—The Mailbag Program on Wednesdays 2230-2300 from TGNA, 9.668, 11.850, is now called "Script By You." (Niblack, Ind.) Heard recently at 1720 *testing* on 11.850. (Guentzler, Ohio)

Haiti — 4VRM, Port-au-Prince has been "wandering" again from 9.963A up to 9.990A. Signs off 2157A with anthem. (Stark, Texas; Bellington, N. Y.) 4VM, 6.005A, Port-au-Prince, noted 1818-1833 with severe QRM from HJKD, Colombia; uses chimes between announcements. (Patterson, Ga.)

Holland—Radio Nederland is scheduled for *English* at 1100-1140 to South Asia and Africa, 17.775, 15.22, 6.025; 1630-1710 to Europe and North America, 11.73, 9.59, 6.025; 2130-2210 to North America, Australia, New Zealand, 11.73, 9.59; the Happy Station Programs on Sundays are listed 0530-0700, 21.48, 17.775, 15.22, 6.025, to Far East, Pacific Area, Europe 1100-1230, 15.22, 11.73, 9.59, 6.025, to Near and Middle East, Europe; 1630-1800, 11.73, 9.59, 6.025, to South and Central America, and 2130-2300, 11.73, 9.59, to North America. Baetz, Ill., notes the 9.59 channel at good level 1630.

Hong Kong—ZBW3, 9.525, heard 0530 at good level with news, weather report, music. (Sanderson, Australia)

Hungary — Radio Budapest, 9.833, noted 1600 with news; on Sundays has Mailbag session 1818. (Hoffman, N. Y.) Heard on 11.910 around 1940 with *English*. (Bellington, N. Y.)

India—VUD11, 11.850, Delhi, signs on 2030 and begins transmission in Persian or Afghan-Persian; weak to fair, severe flutter-QSB. (Kary, Pa.) This one has improved level in news 1930. (Mast, N. Y., others) Noted on 11.940 with news 1030. (Rosenauer, Calif.)

Indo-China — Radio France-Asie, 11.924A, Saigon, noted 2030 with French program of news and music; on 15.444A at 0430 with news, music. (Sanderson, Australia) The 11.924A channel noted closing down 1053. (Harris, Calif.) The 9.754A channel logged with news in French 1015, signing off 1030 with "La Marseillaise." (Lepple, Germany, via URDXC) Noted on 6.116 at 1730 and testing to Europe around 1035-1100 on 15.430A (*measured* 15.428 by Hutchins, *Radio Australia*), asking for reports to P.O. Box 412, Saigon. (Pearce, England) The N. Z. DX Times says Saigon is using 15.420 at 0415-0515; news 0500; new address is 86, Rue Marechel de Lattre de Tassigny, Saigon, or P.O. Box 412, Saigon; *English* newscasts are now listed as 1730-1745 on 6.116 (to Europe), 1900-1915, 9.750 (to S. E. Asia), 2030-2045 on 11.920 (to India), 0500-0515, 15.420 (to Australia-N. Z.); 0900-0915 on 11.920 (to India-South Africa). (Cushen, N. Z.)

Radio Hue, 7.205, noted 0215-0245 sign-off with all-French session; news in French 0230. (Saylor, Va.) "Voice of Vietnam," 7.090A, Saigon, noted 1800 with oriental music; woman announcer. (Pearce, England)

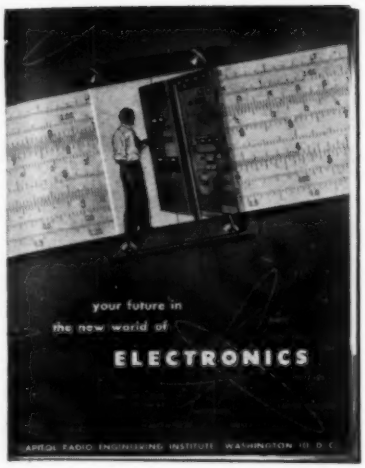
Iran—EPB, 15.100, Teheran, noted with call 1430; German 1430; French 1445; *English* 1500; Russian 1515; signs off 1530; calls these sessions "The European News Service." (Pearce, England) Ends Home Service relay 1430 (Kary, Pa.)

Iraq—Radio Baghdad, 11.724A, is heard occasionally with *English* 1415-1500 sign-off; has bad QRM (squeezed). (Kary, Pa.)

Ireland (Eire)—ISWC, London, says *Radio Eireann* now broadcasts news bulletins 1330-1350 over 15.120 and 1710-1730 over 9.595. *Not confirmed.*

Israel—4XB24, 8.170, Haifa, noted 1530 with religious service. (Sanderson, Australia) 4XB44, Galei-Zahal, 6.725, is on the air this summer 1030-1400; QRA is A.P.O. 162, Israel; is Forces Station. (O'Sullivan, Pearce, England) Tel-Aviv now has news 1415 on 9.010, 6.830; announces next regular *English* period for these channels at 0545, and "Voice of Zion" (*English*) session for 9.010 at 1515; is summer schedule. (Pearce, England) Noted closing 1600 on 9.010. (Ferguson, N. C.)

Italy—Rome, 21.560, 15.400, noted with news for Far East 0600; to Great Britain and Ireland signing on 1350, closing 1435, best on 11.91A, 6.010 (also audible from 1415 on 9.57A). (Pearce, England) Rome heard with *English* for North America around 1900 on 9.575, some CWQRM, parallel with 11.905A. (Hoffman, N. Y.) Noted on 17.800 at 1145 with news in Italian. (Bishop, Ohio)



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Italian Somaliland — According to verification, *Radio Mogadishu* operates its 300-watt transmitter on 7.420 at 0530-0645, 0915-1015, 1200-1300 in Somali and Italian; however, the frequency seems nearer 7.383; has bad QRM. (Radio Sweden)

Jamaica—*Radio Jamaica*, 3.360, still noted closing down 2300A. (Baetz, Ill.) The 4.950 channel is good level around 1100 in Cuba. (del Pozo G.)

Japan—JOB, 6.069, noted 0600 with news; JOA, 7.180, heard parallel. (Sanderson, Australia) Is heard with weak level in Michigan in *English* 0600, 0700 on 7.180. (Fried) *Radio Japan* sent schedules for North America 0000-0100, JOA4, 15.235, JOB2, 11.705; for North China 0600-0700, JOB, 6.069, JOA, 7.180; for Central China 0700-0800, JOB, 6.069, JOA, 7.180; for Philippines and Indonesia 0900-1000, JOB2, 11.705, JOA2, 9.675; for India 1030-1130, JOB2, 11.705, JOA2, 9.675. (Dematteï, Calif.) Changes noted also by McPhadden, Calif.; Oestreich, Wash. State, others. NHK, Tokyo, is now heard 0400 on 6.175, parallel 4.930, 7.285. (Rosenauer, Calif.)

Kashmir—*Radio Kashmir*, Srinigar, now operates 2130-2330 on 3.335; 0100-0230 on 6.110; 0630-1200 on 3.335. (N. Z. DX Times)

Kenya Colony—Nairobi, 4.855, noted closing 1500 with "God Save the Queen." (Pearce, England)

Lebanon—Beirut, 8.036A, still has *English* period daily 1000-1100. (Pearce, England)

Liberia — ELBC, 6.028, Monrovia, noted signing off 1846; fair level but heavy QRM. (Ferguson, N. C.)

Luxembourg — *Radio Luxembourg* has dropped the 19-m. (15.350) channel and now transmits on 6.090 at 0600-0800 in Flemish, 1300-1900 in *English*. (WRH)

Malaya—BFEBS, 15.435, Singapore, noted at good level around 0758; had BBC news relay 0800. (Ferguson, N. C.) Current (announced) schedules are to India and Pakistan 0800-0900, 17.755; 0915-1030, 15.435; 1030-1135, 17.755, 15.435. To Burma and Thailand 0800-0815, 11.955; 0815-0900, 7.120; 0900-1030, 11.955; 1030-1135, 11.955, 7.120. (Catch, England)

Mexico—XEX, 6.065, noted opening 0800. (Stark, Texas) XEEP, 6.155, Mexico City, heard around 2115-2200 with bad QRM. (Robbins, Ind.)

Monaco—Monte Carlo, 6.035, 9.785, still noted Fridays with *English* program ("Back to the Bible") 1730-1800A sign-off. (Bellington, N. Y.)

Mozambique—When this was compiled, Lourenco Marques was still using 9.79A for its Portuguese session starting 0000. (Bellington, N. Y.)

New Zealand—Schedules of *Radio New Zealand*, received airmail, include to Australia 1300-1545, ZL2, 9.540; 1600-0145, ZL10, 15.220; 0200-closedown, ZL2, 9.540. To the Islands, 1300-1545, ZL8, 9.620; 1600-0145, ZL4, 15.280; 0200-closedown, ZL8, 9.620. Closedown at present is 0545 weekdays; 0620 Sat.; 0500 Sun. Dematteï, Calif., notes the 11.78 channel quite

Maximo D. Atienza is station manager of the Far East Broadcasting Company, Manila. "Call of the Orient" uses six transmitters and 32 languages and dialects to "bring the Orient the Gospel of Christ."

strong 2300-0130; Bishop, Ohio, finds the 15.280 channel reasonably good around 2105-2130.

Nicaragua — YNEQ, Managua, *La Voz de Victoria*, is still on 6.065; identifies 0725. (Stark, Texas)

North Korea—GDX-aren, Sweden, reports Pyongyang on 4.400A around 1550 to sign-off 1800; relays *Radio Moscow's* Korean program 1730-1759.

Outer Mongolia—Ulan-Bator-Choto noted on 6.430 parallel 5.265 around 1830-1935. (GDX-aren, Sweden)

Pakistan — *Radio Pakistan* noted opening 2015 with announcement "You are listening to a test transmission from Radio Pakistan directed to Southeast Asia on 11.885 and 15.?? (probably 15.270) in the 25- and 19-meter bands"; weak level on 11.885. (Niblack, Ind.) Heard in Australia on 11.885 at 0500 with news and music in Home Service; on 15.270 at 2130 with *English* news, music; on 7.010 at 1535. (Sanderson) Noted signing on 1430 in *test* to Turkey; from 1515-1600 to United Kingdom; on 7.010, 9.484. General Overseas Service in slow-speed news noted 1210-1230 now on 7.010, 9.484; Western music heard with *English* announcements from Dacca, 15.620, at 0400-0430; still *tests* to Indonesia 0630-0715 at 17.835, 15.270. (Pearce, England)

Panama — *Radio Programas Continental*, 5.99A, noted 2230; news in Spanish 2245. (Niblack, Ind.) A harmonic of this one has been found around 11.990. (Stark, Texas) HOLA, 9.505, Colon, signs off weekdays 2300 but runs on Saturdays to 0200 (Sun.)

Peru — OAX4T, 9.562, Lima, noted 0015 at excellent strength in Spanish program of music and news. (Sanderson, Australia) Noted parallel with 6.080A recently around 2300 and signing off 0053. (Bellington, N. Y.) Lima, 15.105, heard with music and announcements in Spanish when tuned 1940; identified 1945. (Ferguson, N. C.)

Philippines — Sanderson, Australia, reports DZH7 on 9.755 with religious

program 0430; DZB2, 3.320, at 0500 with news, music. Stark, Texas, notes DZH5, 9.690, fading in 0800; *English* heard to *after* 0830.

Poland—Warsaw noted at good level on 7.145 in *English* 1615-1645; also audible on 7.205, 9.556. (Pearce, England) Noted on 11.74 at 1700-1800 in *English*. (Baetz, Ill.) Good level in *English* to North America 0715-0800 on 15.120. (Fried, Mich., others)

Portugal—Radio Clube Portuguese, Parede, uses CSB51, 12.865, at 0400-0800, 1300-1900 (Sun. 0400-1900); all-Portuguese with newscasts 0500, 0700, 1330, 1845. (WRH) Lisbon, 9.745, 11.962A noted lately running as late as 1830 closedown. (Niblack, Ind.; Bellington, N. Y., others)

Portuguese India—Radio Goa, 9.610, is heard in Sweden some days 1030-1100 with "Bringing Christ to the Nations" (*English*). (*NATTUGGLAN*, Sweden) Noted on 17.895 at 0230 with request program of popular tunes and commercial announcements; heard to 0400 at fair strength. (Sanderson, Australia) Normally runs to 0430A but sometimes is used 0435-0450 for a transmission to Portugal. (Radio Australia)

Roumania—Bucharest can be heard 1400 with *English* session on 9.252. (Radio Sweden; Pearce, England)

Sierra Leone—According to "Radio Amateur," London, the experimental station at Freetown has closed down, due to lack of funds. Experimental broadcasts, mostly relays from the BBC, were carried out until July 14, 1951, around 0600-0900, 1300-1700, over 9.630 using a *Cossor* Type 1509 transmitter of 300 watts output and a half-wave dipole antenna running N-S at 700 feet ASL.

South Africa—SABC airmailed these current schedules—*Johannesburg—English* program, 4.80 at 2345-0130 (Sun. 0055-0130); 7.229, 0315-0715 (Sat. 0315-0830, Sun. 0315-0800); 4.80, 0900-1320 (Sat. 0840-1315, Sun. 0810-1315); 3.29, 1330-1605 (Sat. 1325-1700, Sun. 1325-1605). Afrikaans program, 4.89, 2345-0130 (Sun. 0055-0130); 7.275, 0315-0715 (Sat. 0315-0830, Sun. 0315-0900); 4.89, 0900-1350 (Sat. 0840-1350, Sun. 0910-1355); 3.45, 1200-1605 (Sat. 1200-1700, Sun. 1200-1605). Commercial Program ("Springbok Radio"), 4.945, 2300-0130 (Sun. 0000-0130); 7.295, 0130-0900; 4.945, 0900-1330; 3.356, 1330-1700 (Sun. 1330-1600).

Cape Town — Afrikaans program, 5.89, 2345-0130 (Sun. 0055-0130); 9.615, Mon.-Fri., 0315-0715, 0900-1330; Sat. and Sun. 0315-1330; 5.89, Mon.-Fri. and Sun., 1345-1605, Sat. 1345-1645. *African Service* (experimental transmitter) — Johannesburg Program, 15.23, Mon.-Fri., 0330-0715, Sat. and Sun. 0330-1045; 11.937, daily, 1300-1505; carries Afrikaans Program, Sun., Mon., Wed., Fri., and *English* Program Tues, Thur., Sat. *Experimental Transmitter* (to South West Africa) — Johannesburg (*English*) Program, 9.68, at same times as Johannesburg *English* programs listed above.

(*Continued on page* 101)

What's New in Radio

(*Continued from page* 80)

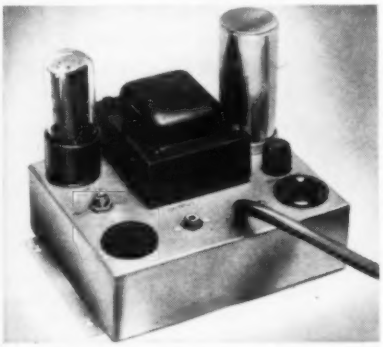
high-heat element is particularly well-suited for production-line work and with the three "Tiplets" is adaptable to a wide variety of production line applications.

Complete data on these new units is available from the company's distributors or from the company direct.

POWER SUPPLY

McIntosh Laboratories, Inc. of Binghamton, New York has introduced a new power supply, the D-101.

The new unit can be used whenever a separate power supply is required to power the company's AE2-A preamplifier-equalizer, when this unit is to be



operated as a remote control panel at a distance greater than 30 feet from the power amplifier, or whenever a general purpose power supply is needed.

The power transformer and rectifier tube are capable of delivering d.c. current up to 40 ma. and by properly modifying the filter circuit, the usefulness of this supply can be extended to this increased current rating. The ripple frequency voltage output level is less than 800 microvolts.

TRANSISTORS AVAILABLE

Federated Purchaser, Inc. of 911 S. Grand, Los Angeles 15, California now has available stocks of the new junction-type transistor manufactured by *Germanium Products Corp.* of Jersey City, New Jersey.

The transistor consists of three tiny crystals of germanium compounds, placed end to end and embedded in clear plastic.

While the initial output of transistors from *Germanium Products Corp.* will most likely be channeled

to top priority development in the field of guided missile flight, etc., accelerated delivery schedules will soon make these units available for civilian markets.

For full details on these transistors and delivery data, write to the national distributor, *Federated Purchaser, Inc.*

HORNS AND SPEAKERS

Racon Electric Co., 52 East 19th Street, New York 3, New York has released a new line of horns and loudspeakers which have been designed especially for use in sound systems requiring high intelligibility combined with mechanical and electrical ruggedness and wide horizontal angle of coverage. All of the models incorporate husky, non-resonant cast aluminum bells.

The COB-15 and COB-16 are of re-entrant design, will handle 25 watts of program material continuously and are provided with driver units enclosed in watertight covers. Response range is 350 to 11,000 cps; horizontal dispersion is 60 degrees; and vertical dispersion 30 degrees.

The Model RE-32 is of "straight" horn design with a nominal cut-off at 500 cycles which results in crisp, highly articulate quality. Horizontal dispersion is 90 degrees, and vertical dispersion is 60 degrees.

The Model CHU is a 15,000 cycle driver unit for use with the RE-32 horn when the latter is employed as a tweeter in two- and three-way high-fidelity systems. When coupled to the proper crossover network, 15-20 watts of program material can be handled.

Technical data sheets on these and other units in the company's line are available on request.

RADIO HARDWARE

Walter L. Schott Co., 3225 Exposition Place, Los Angeles 18, California has introduced a line of radio and tele-

vision hardware which has been designated as the "Walsco 50 Line."

The new line is housed in attractive plastic containers which have unlimited uses on every busy, congested work bench. Each container is clearly marked, and the items are plainly visible, which makes it easy for the technician to select his hardware rapidly.

The "Walsco 50 Line" is now being shown by jobbers throughout the country.

BOOSTER-CONVERTER

Sutton Electronics Company, Inc. of Lexington, Ky. has developed a new booster-converter combination unit which houses both a v.h.f. booster and a u.h.f. converter in a single cabinet.

LEARN Practical RADIO AT HOME

COMPLETE ONLY . . . **$19.95**

BUILD 15 RADIOS

ABSOLUTELY NO PREVIOUS TRAINING NEEDED
EXCELLENT BACKGROUND FOR TELEVISION

FREE RADIO TESTER & SOLDERING IRON

10-DAY MONEY-BACK GUARANTEE

WHAT THE 1952 PROGRESSIVE RADIO "EDU-KIT" OFFERS YOU:

This is a practical home radio course. You learn theory, construction, operation, trouble shooting, code. You build RECEIVERS, TRANSMITTERS, AMPLIFIERS, CODE OSCILLATOR, SIGNAL TRACER.

You start with a simple radio circuit, and gradually advance to more complex circuits. No previous background is required. No instructor is needed. All parts and instructions are included and every single step is clearly explained.

All parts are guaranteed, individually packaged, identified, and explained.

There is nothing extra to buy. You receive all parts, tools and instructions at once. You keep everything; there is absolutely nothing you return to us.

You can easily pay for the kit in a short time by repairing radios. Use the tester and signal tracer for servicing. The signal tracer alone is worth more than the price of the entire kit.

USED BY RADIO SCHOOLS AND GOVERNMENT AGENCIES!

The Progressive Radio "Edu-Kit" includes tubes, paper condensers, mica condensers, electrolytic condensers, variable condensers, selenium rectifiers, chassis, hardware, tie strips, tube sockets, solder, wire, soldering iron, tubing, coils, instruction book, radio tester, etc.; in brief, everything you need in a practical radio course.

Send for further information and receive FREE Radio & TV Trouble-Shooting Guide. Or order direct from this ad and receive FREE Code Oscillator Key (Value $2.95) in addition to Radio and TV Trouble Shooting Guide.

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PROGRESSIVE ELECTRONICS CO.
497 UNION AVE. -:- DEPT. RN-7 -:- BROOKLYN, NEW YORK

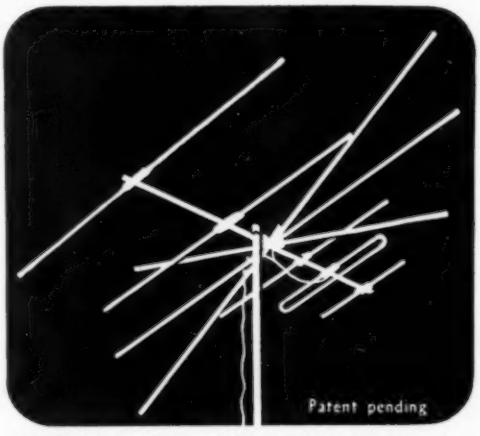
GET A WELL-PAYING JOB

GO INTO A PROFITABLE BUSINESS AND PLAN FOR A FUTURE

"BIG JACK" performs where other high gain antennas fail!

The world's highest gain all-band antenna. The "Big Jack" gives you station cut Yagi performance—yet—you receive all channels 2 through 13. Field tested in many areas by reliable TV technicians, each test proved the ability of "BIG JACK" to deliver sufficient signal to the TV set where other high gain antennas have failed.

- **Radiation lobe:**
  High band: 6° left to right
  Low band: 8° left to right
- **Gain ratio in comparison to dipoles cut to station**
  High band: 8 times dipole
  Low band: 9 times dipole



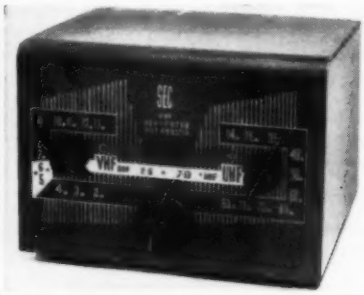
MODEL BJ 1: This model is packed complete with stacking bars in 1 and 2 bay units.

- **Half wave dipoles featured for HIGH GAIN**
- **Fanned to 45° for 300 ohm impedence**
- **Directive reflector for additional GAIN**
- **7/16" aluminum tubing: Crimped ends: Oak Dowel pins**
- **Aluminum Cross Arm**

At your local jobber or distributor **KAY-TOWNES** *Antenna Co.* ROME, GEORGIA

According to the company, installation consists merely of connecting the antenna lead-in from the television receiver to the terminal board at the rear of the unit.

The new unit has its own power supply, a crystal mixer, and two tubes (a



6AF4 and a 6J6). The power supply, which is at the rear of the chassis, operates on 110-117 volt a.c. The 6J6 is used in a balanced push-pull amplifier circuit and a selenium rectifier is used to provide "B+."

Operation of the booster-converter is by means of three control knobs on the front panel, the knob controlling the v.h.f. booster operation is on the left, the u.h.f. channel number indications are at the right, with the tuning knob in the center.

PHONE PLUG

Carter Parts Co., 213 West Institute Place, Chicago 10, Illinois has introduced a miniature phone plug which has been tradenamed the "imp."

The tip and sleeve of the new plug fit standard 2-conductor jacks but the molded Bakelite handle has been reduced to about half normal size. Added convenience and important savings in space are obtained with this new design, according to the manufacturer.

CROSLEY "ULTRATUNER"

The *Crosley Division* of *Avco Manufacturing Corporation*, Cincinnati, Ohio has demonstrated a production model of its "Ultratuner," an ultra-high-frequency adapter which will enable every television receiver ever built by the company to cover all channels in the

present v.h.f. and proposed u.h.f. ranges.

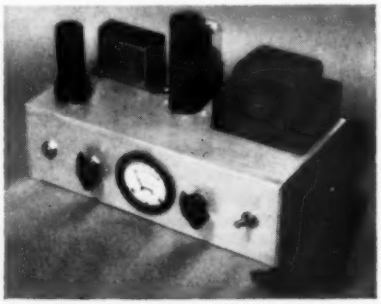
The tuner is housed in a small, attractive plastic case and incorporates a built-in antenna for the u.h.f. band. Provision is made for connecting an outside antenna if required. A flick of the control knob on the front of the "Ultratuner" automatically places either the v.h.f. or u.h.f. antenna in operation.

Although designed for *Crosley* receivers, the new adapter can be used with any continuous tuner set at 127 mc. as the i.f. for the conversion.

NOVICE XMITTER KIT

Arrow Electronics Inc., 82 Cortlandt Street, New York 7, New York has introduced a compact, inexpensive, crystal-controlled, two-tube transmitter which has been designed especially for the beginning ham.

The new transmitter comes in kit form complete with power supply. This 10-watt unit covers the 80-meter band and features a 350-volt power supply, a 0-100 ma. d.c. visual meter, built-in antenna tuner, built-in keying jack, and crystal control between 3700-3750 kc. Tubes used are a 6AG7 and a 6X5 in the power supply. A feature of this unit is that any length of wire up to 125 feet can be used as an antenna.



The kit comes complete with all parts except the 80-meter crystal which is available at a slight additional charge.

ELECTRONIC VOLTMETER

Ballantine Laboratories, Inc. of Boonton, N. J. is in production on its new Model 314 electronic voltmeter.

This latest development in the field of sensitive, wide-band electronic voltmeters measures a.c. voltages from 100 microvolts to 1000 volts in the frequency range 15 cycles to 6 mc. Its accuracy of 3% up to 3 mc. and 5% above is the same at all points on the single logarithmic voltage scale.

With its probe, the input impedance is 6 $\mu\mu$fd. shunted by 11 megohms and the voltage range is 1 millivolt to 1000 volts in 6 decade ranges. Without the probe the instrument may be used to measure down to 100 microvolts but the input impedance is reduced to 25 $\mu\mu$fd. shunted by 1.1 megohms.

One of the unique features of the unit is its probe which has a self-holding connector tip and also a ground clamp especially designed to insure a low impedance ground return.

TV-FM GENERATOR

Radio City Products Co., Inc. of 152 West 25th Street, New York 1, New York is currently in production on a TV-FM generator which has been tradenamed the "Do-All."

This easily-portable instrument provides for the checking of front ends

and i.f.'s, horizontal linearity, vertical linearity, picture size, picture position, focus coil, and ion trap. The unit covers all television and FM bands on fundamentals.

Specifications on this compact instrument are available on request from the company.

-30-

International Short-Wave

(*Continued from page* 97)

"Springbok Radio," 4.945, logged 2335-0015; terrific aircraft QRM; many commercials and frequent time checks noted, also various types of popular music. (Patterson, Ga.)

South Korea—Taegu, 4.770, and Pusan, 7.935A, relay VOA at 0600-0700. (ISWC, London)

Southern Rhodesia — ZEAF, Salisbury, sent schedule of 3.320, 7.5 kw., 7.285, 7.5 kw., 9.490, 1 kw., Sundays 0300-0700, 1100-1500, weekdays 0400-0700, 1000-1500; additional period of BBC news is relayed daily *except* Sundays and public holidays on 3.320, 7.285 at 0100. (Catch, England)

Spain—Radio Nacional de Espana en Malaga, 7.022, has news in Spanish 1545. (Lepple, Germany, via URDXC) Madrid, 9.363, noted with *English* for North America at 1800 and 2215. (Worley, Calif.) Noted signing off 2245 at good level in N. Y. (Shuker)

Sweden — Radio Sweden, 15.155, noted 0900 with news, like a local in Conn. (Babcock)

Switzerland—Berne, 7.210, noted at good level in Fla. around 2030-2130. (Wade)

Syria—Damascus, 11.913A, good level in *English* period 1630-1730 closedown. (Baitzel, N. J.) Uses French on 7.145 at 0230. (Radio Sweden)

Taiwan—"Voice of Free China," 11.920A, Taipeh, noted to Europe around 1400-1530 (when is buried by Damascus signing on); news is around 1420-1445. (Pearce, England) *Radio Sweden* says this one can be heard daily 1400-1600. In verifying the 7.133A channel, Taipeh listed BED6, 11.735; BED7, 7.130; BED29, 6.095; BED2, 670 kc.; BED3, 15.235, and BED4, 11.725; ownership as "The Broadcasting Corporation of China"; sent attractive card in blue and yellow. (Kary, Pa.)

Thailand — Bangkok, 11.910, noted closing in *English* 1025. (GDX-aren, Sweden)

Trans-Jordan—Although the Hashimite Jordan Broadcasting Service Ramallah still lists its frequency as 7.010, it is actually heard in England on 6.995A in Arabic from around 1200 to 1430 closedown. (Pearce)

Trinidad—VP4RD noted on 3.270 to 2200 with good level but terrific QRN. (Robbins, Ind.)

Turkey—Radio Ankara now uses 9.465 and 15.160 for the *English* period for Europe 1600-1645. (Pearce, England) The 15.160 outlet is like a local in West Virginia. (Dalton) Heard signing off 1700 on 9.465. (Guterman, N. J.) Still noted to North America 1815-1900

over TAT, 9.515, good level in New Hampshire. (England)

Uruguay—CXA19, 11.835, Montevideo, noted around 1800 in Spanish. (Mast, N. Y.)

USI (Indonesia) — "Voice of Indonesia," Djakarta, noted with *English* for India-Pakistan 0930-1030 on 15.150, parallel 11.77, 4.910; at 1030 the 11.77 channel closed but continued in Hindi over 15.150, 4.910; noted for Europe and New Zealand 1400-1500 over 11.770, parallel 15.150 (repeat of 0930-1030 session). (Pearce, England) The Indonesian noted around 0645-0930 on 11.093A is believed to be Amboina, Ambon. (Stark, Texas)

USSR—Moscow noted on 5.960 with *English* talk 1738-1742. (Rodger, Scotland) Heard on 15.180 signing on to South East Asia in *English* 0900. (Kary, Pa.) Brydges, N. C., reports Moscow on approximately 15.250 at 1133. Kary, Pa., notes *Espana Independiente* on 12.080A at 1450 in Spanish with strong level; announced 20, 21, and 24 meters.

Vatican—HVJ, 15.120, noted to 1030 sign-off or fade-out; *English* 1000. (Kary, Pa.) Heard on 5.968A with Slovak language session 1600; QRM'd by jammer. (O'Sullivan, England)

Venezuela—YVOC, 4.713, Coro, has splendid signal evenings to at least 2130. (Howe, D. C., via URDXC) YVMS, 4.850, Barquisimeto, noted with *English* recordings 1910. (Catch, England) YVLI was *measured* recently on 3.440 at 2150, moved up from 3.430. (Oskay, N. J.)

Yugoslavia — Radio Yugoslavia, 11.895A, noted with news in French 0200; news in *English* 0215. (Sanderson, Australia; Pearce, England) Noted on 9.505 with call 0930, followed by news in Russian. (Pearce) By now should be *testing* its *new* 100 kw. transmitter, to be used for beams to North America.

* * *

Press Time Flashes

Radio Africa, 7.125A, noted 0920 with Spanish music and songs; signed off this period 1104. (Pearce, England)

The transmitter of the Physical Institute of Istanbul University, Turkey, was built as a meteorology station and is being *tested* irregularly; may broadcast from 7.1 to 7.3 and from 15.1 to 15.45; output 0.6 kw.; a regular transmitter for the University is under construction, to be 0.5 kw. Schedule is Mon., Wed., Fri. 0600-0700. Tue., Thur., Sun., 1330-1500; programs consist of recorded music. The Technical School of Istanbul operates around 7.1 with an output of 0.05 kw. daily 1230-1330 using recorded Turkish and Western music. *Radio Izmir*, Smyrna, has 0.4 kw. and uses 6.4A at 1100-1430; relays news 1200 and commentary 1315 from *Radio Ankara* (presume this is Turkish—K. R. B.); transmissions are irregular. (WRH)

The British Far Eastern Broadcasting Service, Singapore, is now using 11.820 at 0800-0830 to relay BBC news to *Radio Australia*. (Hutchins, Radio Australia)

Radio Jornal do Commercio, Recife, Pernambuco, is now using ZYK2, 15.145, noted 1130 and signing off 1300 with announcements in *English*. (Boice, Conn.)

Radio Free Asia has added another Chinese dialect (Hakka) to its sessions to Asia; Hakka is heard 0910-0920; is on the air now daily *except* Mon. 0700-1020 on 9.490, 11.940, 6.110, and also uses Cantonese, Mandarin, *English*. The 6.110 and 11.940 channels are relays via Manila, while 9.490 is relayed from Guam.

Sutton, Ohio, reports the *Free Greek Radio* on 9.457A in native 1300-1325, S7.

Radio Sweden's latest schedules are —*Overseas Service*—To Eastern Seaboard of North America 1900-2145, 11.880; 0700-0745, 15.155. To Western North America, 2300-2345, 11.705; 1600-1700, 15.155. To South America 1900-2100, 11.705; 0600-0645, 15.155; 1800-1900, 11.705. To Far East, 0800-0845, 15.155; 1800-1845, 15.155. To South East Asia and Western Australia, 2300-2345, 15.155; 0900-0945, 15.155; 0945-1030, 15.155. To Middle East, 2200-2245, 11.705; 1200-1245, 15.155. To Africa, 0000-0100, 15.155; 1300-1345, 15.155. *European Service*—Swedish 1400-1430; German 1430-1500; *English* 1500-1530; French 1530-1545, all on 9.620. *Swedish Home Service* —0000-0500 (Sun. 0000-0400), 6.065; 0500-1110 (Sun. 0400-1110), 11.705; 1110-1700, 6.065; the Swedish Home Service also is broadcast from Motala, 12 kw., on 7.270. The Overseas Service uses 100 kw.

A station measured on 7.114, noted 1645 tune-in, is believed to be Praia, Cape Verde Islands; closed with "A Portuguesa" 1700. (Ferguson, N. C.)

Radio Free Europe has been using these *measured* channels—5.970, 5.985, 6.122, 6.150, 6.225, 7.145, 7.190, 7.284, 9.248, 9.608, 9.696, 11.450, 11.917, 12.190. (WRH)

Predicted Zurich sunspot number for July is 51, the same as for February; March-June prediction was 52. (Stark, Texas)

At press time, Warsaw seemed to be using 11.815 for its "evening" (*EST*) sessions to North America in *English* around 1700-1800, 1930-2000, 2315-2345, 0030-0100. (Bellington, N. Y., others)

Regional stations in Iran are listed by Bluman, Israel, as Tabriz, 6.092, 0930-1300 in Persian and Azerbaijani; Meshed, 8.015, at 0830-1015 fade-out (oriental); Shiras, 6.845, at 0830-0945 fade-out (Persian and oriental); Isfahan, 7.960, at 0830-1130 sign-off, uses 12-tone interval and has interference from the Kozani, Greece, outlet.

Radio Tetuan, Spanish Morocco, now operates on 6.037; heard *after* 1600. (Radio Sweden) WRH lists these summer schedules for Prague, Czechoslovakia—6.010, 2315-2355; 9.505, 0100-0200; 9.550, 1500-1530, 1600-1630, 1700-1820, 1930-2030; 11.760, 0400-0430; 11.840, 0545-0745; 17.830, 0750-0800; *English* 0715-0745 on 11.840, 1400-1425 on 9.505, 1930-2000 on 9.550.

Japanese Time is now 14 hours *ahead*

COMMUNICATIONS EQUIPMENT CO.

UPRIGHT OIL CAP

MFD	Each
220VAC/600VDC	
6.2	$ 1.29
15	3.49
330VAC/1000VDC	
15	3.79
1000VDC	
.5	.69
.5-.5	1.19
1	1.49
4-1.5	2.19
1.5	1.39
1500 WVDC	
1	1.59
1.5	1.59
2	1.79
2000 WVDC	
1	1.79
2500 WVDC	
.5	2.98
4000 WVDC	
.15	6.95
4800 WVDC	
.1-.1	4.79
6000 WVDC	
.1	3.69
.15-.15	3.89
1.5	10.98
7000 WVDC	
.1-.1	3.79
1	9.95
8000 WVDC	
.075-.075	3.79
10K VDC	
1	28.95
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.0016	7.95
16K VDC	
.015	9.50
20K VDC	
.25	17.50
25K VDC	
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AN/109-A Antenna 1.98
C-30 ARC-5 Control Box..... 2.35
EE-89A Telephone Repeater... 12.50
EE-65A Telephone Test Set... 50.00
ID24/ARN-9 Cross Point Indicator 6.95
TU-8 Tuning Unit 6.2-7.7mc.. 4.95
BC456-A Dual Rcvr. Con'l box, 3-6 & 6-9.1mc..... 1.75
AN/104-A Antenna, 150mc.... 1.49
BC704 Indicator, 3" CR Tube, New 22.50
BC929 Indicator, 38P1, all tubes, New 29.50
NOISE Filters, 100 AMP, G.E. 1.39
MC211 Right Angle Drives.... .19
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926B-16	926C-19	
926K-2	926C-15	@ 22¢ ea.
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		Each
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C-382	3200-4000 kc	.97
C-184	4-5mc (with 4405kc Xtal.)	1.95
C-484	5-6.2mc	.97

Dual Coil Set, C-430 for BC-429 Rcvr., Ranges: 201-390 kc and 2.5-4.7mc 1.29
BC 306 ANTENNA TUNING UNIT, NEW $6.95
R9/APN-4, New, With Tubes.. 75.00
106/APN-4, New, With Tubes and Crystal 75.00
A-62 Phantom Antennae 8.50
2 Meter Choke, 1000 MA, 20-144.8/1.00
Supersonic Crystal Head, M1-2, 22-27KC HI-2 ..... 27.45
Underwater Microphone, Model JR, Z=50W 24.50
Dynamic Mike & Headset Combo, H-19, New 3.75
HS-30 Inserts, M-300. $3.50 per M
AN/ARC-4 VHF Trans-Rcvr... 75.00
IE 36 Test Set, New 37.50
SCR 274 Test Set, I-104..... 42.25
Carbon Pile Reg., 18V-.5V —35X025 ..... 1.29
ART-13 Driver Trans. 6V6 to P-P 811's 1.29
DM 34 Dynamotor, 14V In, 220V 80 MA out..... 12.95
Sens. Relay: 3.5MA, 15K ohms, 2PST, 2A 1.29

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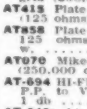
AT201 50L6 output (4000 ohms) to V.C. (3 ohms) $0.40
AT SUB Subouncer, Multimatch, 200 ohms to 15 K ohm C.T. and 100 K ohm Grids $0.69
AT781 H.F. Plate (1500 ohm C.T.) to V.C. (16/4 ohms) 20-15KC $3.29
AT501 HI-FI Special: **PRI:** 3000 ohms P.P. Sec: 4/16/12/50/200 ohms 60-10,000 CY.—1 db 50W..... $3.49
AT152 Hi-Fi Driver Pri: 10,000 ohms Sec: 40,000 ohms P.P. Grids 50-15 KC (1 db $1.49
AT062 Output to H.S. or line PRI: 14,200 ohms SEC: 8000/600 ohms $1.10
AT449 HI-FI Driver (5000 ohms) to P.P. output grids (4,000 ohms) 100-10,000 CY, 10 W 6V6 to PP 805's..... $2.39
AT666 Intercon Input: Spkr (4-8 ohms) to grid (250,000 ohms) $0.69
AT415 Plate (18,000 ohms C.T.) to line (125 ohms) 175 w.—500-600 CY.. $1.95
AT858 Plate (10,000 ohms C.T.) to line (125 ohms) 125136 ohms) HI-FI—50 w. $6.95
AT970 Mike-or-Line (250 ohms) to grid (250,000 ohms C.T.) $1.20
AT-694 HI-FI Output: 3 Watts, 8500 Ohms P.P. to V.C. (15 Ohms) 15-15KC PM 1 db $1.49
AT-649: Line (500 ohms) to Grid (75K ohms) $0.89
AT-448: Line (600 ohms) to V.C. (6 ohms) 17 d.b. Level $1.19
AT-631, Mike-or-Line (200 ohms) To Single or P.P. Gride (50K Ohms)..... $0.59



DYNAMOTORS

Type	Volts	Input Amps	Output Volts	Output Amps	Radio Set
PE86	28	1.25	250	.060	RC36
DM41G	24	6.2	330	.170	RU 19
DM33A	28	7	540	.250	BC 456
PE101C	13.26	12.6	400	.135	SCR515
		6.3	800	.020	
DB AR 93	28	3.25	375	.150	
23350	27	1.75	285	.075	APN-1
ZA0515	12 24	4 2	500	.050	
B-19 pack	12	9.4	275	.110	MARK11
			500	.050	
D-104	12		225	.100	
			440	.200	
DA-3A	28	10	300	.060	SCR522
			150	.010	
		14.5	5	.5	APN-1
5053	28	1.4	250	.060	BC-375
PE73CM	28	19	1000	.350	
CW21AAX	18	12.6	400	.135	
	26	6.3	800	.020	

SCOPE TRANSFORMER

PRI: 115V, 60 Cy., Sec. 3000V/5 MA, 6.4V/6.7A, 6.4V/6A, 5V/3A, 360-0-360V/200 MA, 1.25V/.3A $3.95

POWER TRANSFORMERS

Comb. Transformers—115V/50-60 cps input

CTJ5-2-600VCT/.2A, 5V/6A				$5.95
CT-15A	550VCT	.085A	6.3V/.6A, 6.3V/1.8A	2.35
CT-164	4200V	002A/12KV Test, 5VCT/3A/12KV Test, 6.3V/0.6A/5400V Test		12.95
CT-341	1050	10 MA,—625V @ 5 MA, 26V @ 4.5A, 2x2.5V/3A, 6.3V @ 3A....		22.50
CR-825	360VCT	.340A	6.3VCT/3.6, 6.3VCT/3A	3.95
CT-626	1500V	.160A	2.5/12, 30/100	9.95
CT-071	110V	.200A	33/200, 5V/10, 2.5/10	4.95
CT-367	580VCT	.050A	5VCT/3A	2.25
CT-99A	2x110VCT	.010A	6.3/1A, 2.5VCT/7A	3.25
CT-403	350VCT	.026A	5V/3A	2.75
CT-931	585VCT	.086A	5V/3A, 6.3V/6A	4.25
CT-610	1250	.002A	2.5V/2.1A, 2.5V/1.75A	4.95
CT-137	350VCT	.026A	5V/3A	2.75
CT-866	330V	.065A	6.3V/1.2, 6.3V/600 MA...	1.75
CT-456	390VCT	30MA	6.3V/1.3A, 5V/3A	3.45
CT-160	800VCT	100MA	6.3V/1.2A, 5V/3A	4.95
CT-931	585VCT	86MA	5V/3A, 6.3V/6A	4.95
CT-442	525VCT	75MA	5V/2A, 10VCT/2A, 50V/200MA	3.85
CT-720	550-0-550V/250 MA, 6.3V/1.8A			8.95
CT-43A	600-0-600V/08A, 2.5VCT/6A, 6.3VCT/1A			6.49

Filament Transformers—115V/50-60 cps input

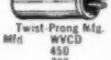
Item	Rating	Each
FT-674	8.1V/1.5A	$1.10
FT-157	4V/16A, 2.5V/1.75A	2.95
FT-101	6V/.25A	.79
FT-924	5.25V/21A, 2x7.75V/6.5A	14.95
FT-824	2x26V/2.5A, 16V/1A, 7.2V/7A, 6.4V/10A, 6.4V/2A	8.95
FT-463	6.3VCT/1A, 5VCT/3A, 5VCT/3A	5.49
FT-55-2	7.2V/21.5A, 6.5V/6.95A, 5V/6A, 5V/3A	8.95
FT-986	16V @ 4.5A or 12V @ 4.5A	3.75

1 PER CENT PRECISION RESISTORS

OHMS	OHMS	OHMS
5	150	7,500
5.05	250	10,000
10.1	430	12,000
18	468	17,000
82	880	20,000
120	920	30,000
125	1100	35,000
128	4300	84,000

30c EACH 10 FOR $2.50
100K 120K 150K 220K
40c EACH 10 FOR $3.50
1 MEGOHM EACH 75c

ELECTROLYTICS



Twist Prong Mfg.

Cap. Mfd	WVCD	Price
8	450	$0.16
30	300	.18
40	450	.38
50	400	.36
60	300	.21
80	150	.29
80	500	.43
8-8	450	.24
30-20	25	.16
20-10	150	.23
80-80	300	.21
90-10	350	.21
80-10	450	.49
150-50-25	150	.49
80-10-10-10	350	.21
40-40-20-2	150	.28
30-15-15-15	300	.28
80-10-10-10	350	.32
4/10	450/350	.55
40/20	150/25	.21
40/50	400/300	.28
80/50	450/50	.65
250/1000	10/6	.30
8-8-10	450/25	.26
10-10/10	150/25	.23
10-10/20	450/25	.26
10-15/20	350/25	.18
15-15/10	450/350	.23
16-16/25	450/50	.23
80-40/150	400/50	.45
120-60/20	150-25	.45
30-30-15/30	300/50	.39
40-40-20/20	350/15	.28
60-40-20/50	200/25	.28
60-40-20/200	150/10	.39
60-40-30/20	150/25	.36
80-40-30/100	150/25	.36
8/8/8	475/100/100	.23
10/50/100	350/100/50	.23

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of *EST* throughout the year; the Summer Time system has been dropped. (WRH)

Summer schedules of Berne, Switzerland, include to North America 2030-2300, 6.165, 7.210, 9.535, 9.665, 11.865; to South Africa 0945-1130, 15.305; to Eastern Australia, New Zealand, 0215-0300, 11.865, 15.305, 17.784; to Western Australia, Far East, 0400-0445, 11.865, 15.305, 17.784; to South East Asia, Japan, 0745-0930, 11.865, 15.305, 17.784; to India-Pakistan, 0945-1030, 11.865, 17.784; to the Middle East, 1145-1230, 11.865, 15.120; to United Kingdom, Ireland, 1345-1530, 9.665, 6.055. Spanish and Portuguese, 1545-1715, 9.665, 6.055. To Latin America (Portuguese 1800-1815; Spanish 1830-2000), 11.865, 11.715, 9.665, 9.535, 7.210. For Europe 0015-0140, 0500-0830, 1000-1730, 6.165, 9.535. For Africa 0015-0140, 15.305; 0500-0730, 17.784; 1130-1730, 15.305.

JBD4, Kawachi, Japan, noted at high level on 15.235 at 0105. (Tarr, Wash. State) Budapest, 11.91, Hungary, noted 1720 in *English*. (Lund, Iowa) GDX-aren, Sweden, reports CR6RG, *Radio Diamang*, Dundo, Angola, is now on 6.860, heard around 1300-1430. And says Forces Broadcasting Station, 7.950A, Kozani, Greece, is heard in Sweden 0100-0130.

American representative of the Arctic Listeners Club, Tromso, Norway, is "Robby" Brown, 32 Kingsbury Road, New Rochelle, New York, to whom inquiries as to membership should be addressed. This new club issues a periodic bulletin called "Nordlyset" ("Northern Lights"); it soon will carry some articles in *English* in addition to Norwegian.

Radio Bucharest, Roumania, now operates four m.w. channels and s.w. 5.932; *Radio Roumania Libera* broadcasts on 6.210, 9.254, and *new* 12.032 (formerly 11.910). (Radio Sweden)

Rome, 15.400, noted with news 1245; *Radio Sweden*, 15.155, good level 1300 in *English* for Africa. (Leary, Ind.) VP4RD, 9.625, Port of Spain, Trinidad, noted 0700 with sponsored programs. (Robinson, N. Y.)

Belgrade, 9.505, Yugoslavia, noted afternoons to sign-off 1800A; *no English heard*. Stockholm's 9.62 outlet noted around 1520 with *English* session in European Service. Madrid, 9.363, recently announced it is installing 120 kw. short-wave transmitters. Copenhagen 9.52, is scheduled to North America 2030-2130 and 2200-2300. *Radio Free Europe* officials advise that most transmissions are confined to channels of 5.970, 5.985, 6.020, 6.095, 6.150, 7.145, 7.192, 9.607, although some other channels are being used irregularly for experimental purposes. (Bellington, N. Y.)

Radio Progresso de Honduras, 6.239, San Pedro Sula, Honduras, is heard by 1900 and runs past 2230. (Stark, Texas)

* * *

Acknowledgment

Thanks for the fine reports. Keep them coming to Kenneth R. Boord, 948 Stewartstown Road, Morgantown, West Virginia, USA. . . . . K.R.B.

Technical BOOKS

"TRANSMITTING VALVES" by J. P. Heyboer and P. Zijlstra. Published by *Philips Gloeilampemfabrieken*, Eindhoven, Netherlands. 281 pages. Price $6.25. Available in the United States from *Elsevier Press Inc.*, 402 Lovett Blvd., Houston 6, Texas.

Although the subject matter of this book covers a relatively limited field of electronic engineering its appearance fills a long-existing hiatus in the literature.

The discussion has been confined to the use of pentodes, tetrodes, and triodes in transmitter circuits with the result that each tube type is covered thoroughly and painstakingly.

The book itself is divided into nine chapters and an appendix. The chapters cover the technology of transmitting tubes, the classification of such tubes, the triode as an r.f. power amplifier, the tetrode and pentode as r.f. power amplifiers, modulation of the r.f. power amplifier, transmitting tubes as oscillators, transmitting tubes as frequency multipliers, special tube data, and the use of transmitting tubes in high frequency applications.

The appendix includes Simpson's law, the a.f. amplifiers operating class A and class B, and constant current characteristics.

Both the advanced student and the professional engineer will find a wealth of practical data at his fingertips with this book in his library.

* * *

"SURVEY OF RADIO-FREQUENCY TRANSMISSION LINES AND WAVE GUIDES" by E. S. Winlund. Published by *The Radio Club of America, Inc.*, New York. 65 pages plus catalogue section. Price $1.50. Paper bound.

This compact publication is, in reality, Vol. 28, No. 2 of the *"Proceedings of The Radio Club of America, Inc."* but because of the widespread interest in the subject matter of this particular issue, copies are being offered to the general public.

The book contains a comprehensive historical survey of the field of transmission lines and wave guides, plus essential technical data condensed from articles on the subject published between 1919 and 1936. A 17-page bibliography lists additional sources of information on the topics.

Charts, tables, diagrams, and photographs form an essential part of this discussion and they, along with the necessary mathematical formulas, enable the author to present a great amount of material in a relatively few pages.

For persons whose vocational or avocational interests lie in the field of transmission lines and wave guides, this book offers a wealth of pertinent information.

—30—

Multi-Band Circuit

(*Continued from page 45*)

The stability of this transmitter is excellent, which is mainly due to: 1. Use of bandpass couplers throughout; 2. Class A buffer following the v.f.o.; 3. Shielding of the low-level couplers; and 4. All decoupling connections to one point on the chassis for each tube.

Even on 3.5 mc. it is possible to tune the final through resonance without loading or without noticeable drift of the v.f.o. One must realize that the oscillator is on the same frequency as the final amplifier. The use of the bandpass couplers eliminates any unwanted driving voltage at harmonic frequencies, which is important in avoiding TVI. On the high frequency bands we still have push-pull operation which keeps the even harmonics down to a low level.

The ease with which this rig, with only two controls, can be operated for QSYing in a band is well worth the labor involved in constructing the bandpass couplers.

Almost any exciter can be adapted to this multi-band tank circuit. The essential features which such an exciter should have include availability of output on all the desired bands and the inclusion of the final grid and plate circuits as shown.

REFERENCES

1. *QST, March 1949.*
2. *CQ, April 1950 and QST, August 1950.*
3. *Patent applied for.*

-30-

PROTECT PICTURE TUBES

By H. LEEPER

CATHODE-RAY tubes from TV receivers will roll if placed unguarded on the service bench. An open metal ring, shown in the photograph, will keep the tube from rolling and bumping against another tube or part.

The open or half-ring was cut from a discarded photographic diffuser but even the handle from a paint bucket could be so utilized.

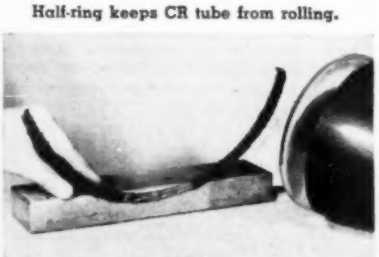
The ring is fastened with a screw to a heavy wooden block but may be attached to the bench itself if room can be spared for it.

Such an open ring will hold the tubes of older receivers, i.e., those mounted separately from the chassis, while the set is in operation on the bench.

While the half-ring shown is about 11 inches across, it will catch the larger tubes at some point where they may be held.

-30-

Half-ring keeps CR tube from rolling.



Which Tube for Audio?

(Continued from page 46)

they do, with the aid of such a set of curves. Fig. 1 is a set of curves for a hypothetical medium-mu triode. Assume the grid operating point to be—24 v. (225 v., 32 ma.). The dotted line, *AB,* is the load line. The power output is one-eighth the area of the triangle *ABC,* about 1.1 watt. The question of how to get more power is one of how to enlarge this triangle. The main barrier is the zero-grid-bias line. We can't go to the left of this line without drawing grid current.

One way is to drive the grid positive. Then we would be operating over the line *A'B,* the power output would be proportional to the area of the larger

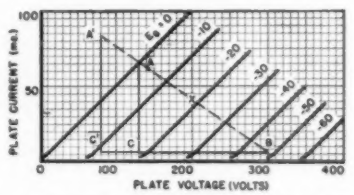


Fig. 1. Power output calculation for a hypothetical triode of the medium-mu type showing the reasons for its low power output.

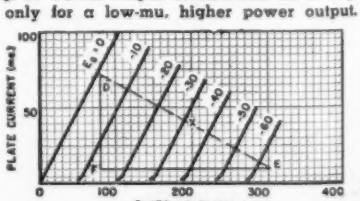
triangle *A'BC'*, and the operating point would be *X*, giving class AB_2 operation.

Another way is to use a lower-mu tube. This is shown in Fig. 2. The zero-bias plate curve is now much steeper. We can draw a load line *DE* which is considerably longer without going to the left of the zero-bias line. Power output is now about 2 watts. Note however that it takes about a 32-volt peak signal to drive this low-mu tube, while the high-mu tube of Fig. 1 took only 18 volts.

This leads us to a consideration of what makes a good output tube. The first thing is that it should draw lots of plate current at zero bias. This condition is met by the low-mu tube of Fig. 2. It is also met, incidentally, by pentodes. Look up the curves on a 6V6 or 6AQ5; the 6V6 will draw 120 ma. at zero bias with 250 volts on the screen. This is why pentodes are efficient.

The second thing is that it shouldn't have too low a mu or it will take too much driving voltage. That is the trouble with the 6AS7G as an audio tube. It has splendid plate efficiency with its mu of 2, but it takes around 100 volts to swing the grid. No resistance-coupled amplifier will deliver 100

Fig. 2. Power output calculations as in Fig. 1 only for a low-mu, higher power output.



volts with ordinary plate supply voltages without a lot of distortion.

What we need, really, is a high or medium-mu triode which will draw a lot of plate current at zero bias. This combination of qualities is found in *high-perveance* tubes.

High-perveance is not designed into receiving-type audio output tubes particularly, because the same combination of qualities is found in pentodes and beam power tubes. This parameter is high when the cathode area is large and the grid-cathode spacing is small.

Another point is that the efficiency of triodes goes up quite rapidly as the plate voltage is raised. The higher the mu, the higher the plate voltage should be for reasonable efficiency. The maximum voltage is usually determined by the plate dissipation rating of the tube. For a triode-connected 6V6, for example, it is better to get an input of 10 watts at 300 volts and 33 ma. than at 200 volts and 50 ma.

Voltage Amplifiers

Voltage amplifiers fall into two categories—low level and high level. For the former the main consideration is hum and microphonics; for the second it is distortion.

The best all-around high-level voltage amplifier tube is the 6SN7 (two 6J5's). These tubes will deliver 20 volts r.m.s. at about 1 per-cent distortion, and 60 volts at 4 per-cent, using the tube manual resistance-coupled-amplifier constants, with a 300-volt plate supply. Matters improve as the plate supply voltage is raised. Omitting the cathode bypass condenser cuts both the gain and the distortion about in half.

The 12AU7 (two 6C4's) is not quite as good, giving about one and a half times the distortion of the 6SN7.

Audio pentodes such as the 6SJ7, when resistance-coupled, have very nearly the same voltage output capabilities as the triodes just mentioned and the same distortion characteristics. Like the triodes, the distortion is mostly second harmonic. There is no particular choice between pentodes and triodes for high-level resistance-coupled operation, except in the matter of gain. The 6SJ7 and the 6AU6 are the best for audio service.

High-mu triodes such as the 6SF5, 6AT6, and 6SL7 at high levels fall in between the 6SN7 and the 12AU7.

There is a host of diode-triode types listed in tube manuals, *e.g.*, 6BF6, which can be safely ignored.

Low-Level Amplifiers

Microphonics and hum are characteristics that vary a lot from tube to tube and which cannot be depended on to stay put even in the same tube. Experience is the best guide, therefore, and there are many newer tube types whose characteristics in these respects are not established because no one has wanted to try them on a commercial scale.

The old top-cap 6J7 is the standby of the broadcast industry for low-level service, *i.e.*, for microphone preamplifiers and so on. The miniature 6AU6 is used in some of the newer audio gear, and measurements made by Lawrence Fleming ("Controlling Hum in Audio Amplifiers," RADIO & TELEVISION NEWS, November 1950) have indicated that the 6AU6 is considerably better. This tube can be triode-connected to give a good triode with a mu of 40. Use a 100,000 ohm plate load and a 2200 ohm cathode resistor. A 6J7, triode-connected, is similar to a 6C5. Both of these tubes are quieter than the 6J5.

Among double triodes, the 6SC7 is considered quieter than the newer 6SL7, but proof is lacking.

The two leading modern types that are especially designed for low noise in audio work are the *RCA* 5879 and the *G-E* 12AY7. The 5879 is a voltage amplifier pentode somewhat similar, electrically, to the old 6J7 and the 12AY7 is a medium-high-mu (60) dual triode; both are nine-pin miniatures. The retail price of each is around three dollars.

The signal level below which one has to worry about using a low-noise tube is around 20 millivolts, that is, for microphone, variable-reluctance phonograph pickups, and tape playback inputs, one should use a quiet tube. All the succeeding stages can be other types.

"Hot" tubes having a high transconductance and designed for video i.f. service and the like, are not considered good for low-level audio service. This includes the 6AK5, 12BH7, 6CB6, and all the others found in TV front ends, i.f. stages, and video stages. The 6AU6 appears to be an exception. However, not too many standard types have been investigated for hum characteristics, and any departure from regular usage must be considered experimental.

The way to find the approximately correct cathode bias resistor for a type not in the resistance-coupled amplifier charts is to select a plate load resistor value used for the nearest listed type, then vary the bias resistor until half the plate supply voltage is dropped across the tube. 47,000 ohms is a good plate load for medium-mu triodes such as 6C4, 6J5, 12AT7, 6J6; 220,000 ohms for the high-mu triodes such as the 12AX7 and 12BZ7.

Power Supply Rectifiers

The old standard 5Y3 is the longest-lived and most reliable as well as the cheapest tube extant when used well within its ratings. For heavier current loads, use the 5U4G and for higher voltages the 5R4GY, an unusually well-made tube. All these types have a drop of around 50 or 60 volts, as does the newer 6AX5. When less voltage loss is desired, use a 5V4G. This is a heater-cathode type rectifier that is directly interchangeable with the 5Y3 but gives about 40 volts more d.c. output. However, this tube has very close cathode-plate spacing, and the writer has seen some of these tubes short out by particles of the cathode coating material coming loose and shorting the cathode to the plate. This does not happen often enough to be serious.

Selenium and germanium power rectifiers are here to stay and will probably gradually replace the tube rectifiers at higher voltages as they already have in a.c.-d.c. sets. At present the selenium stacks require too many plates in series to stand the higher voltages, and are therefore not economical.

Room for Experiment

There are many tubes not designed for audio that seem to have very promising characteristics for such applications. Individual experimenters can do a lot of good by trying out these tubes. (The 6C4-12AU7, incidentally, was not originally designed for general-purpose use, but as a v.h.f. power amplifier).

The 6J6 is a husky, long-lived dual triode which might make a superior audio voltage amplifier. Recent production tubes have double mica spacers inside to reduce microphonics, because of microphonic troubles encountered in these tubes when used as oscillators in TV front ends. The tube has a folded heater, rather than a double-helix, and so may tend to hum at audio frequencies.

The article by Fleming, mentioned previously, reported good results on 12AT7's as low-level amplifiers, but tube manufacturers are unhappy about this type because the extremely close mechanical spacings inside make it very difficult to produce. There may be a trend away from the 12AT7 in spite of its excellent characteristics. The 12AT7 electrically is almost identical with the 6J6, except that it has separate cathodes.

The new 12BH7 is a husky dual triode, designed for TV vertical deflection service, which should be better than the 6SN7 for driving audio power stages. Three other new types are the recently advertised 12A4, 12B4, and 12BZ7, designed for TV sweep and sync separator applications. The 12A4 is a very high-perveance triode with a mu of 16, the 12B4 similar but with a mu of 6.5. Both should make superior high-level voltage amplifiers, and the 12B4 looks like a lulu of a small power output triode, except for its too-low plate dissipation rating of approximately 6 watts.

The 12BZ7 combines a very high mu of 100 with an abnormally high plate current at zero bias. It may possibly replace many older high-mu dual triodes, combining as it does the capabilities of high gain and high output. All these high-perveance tubes should be advantageous for driving class AB_2 amplifier grids (particularly the 12A4 and 12BH7), and for driving class AB_1 tubes with fixed bias, where low-value grid leaks of 50,000 or 100,000 are required.

—30—

The "Q-Tee"

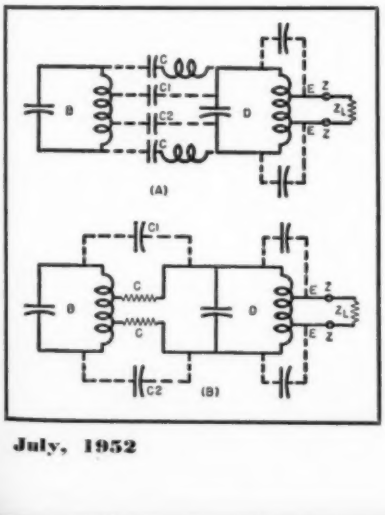
(*Continued from page 57*)

series-type "T" matching transformer. A half-wave antenna has a center impedance of roughly 72 ohms. This impedance increases toward opposite ends of the antenna, and at some points there exists a match impedance of 300 ohms. In the low-channel range the high-channel receiving element *D,D* no longer has the same impedance value (because of current distribution *vs* length) as it did on Channels 7-13. The filters *C,C* are now almost perfect electrical short circuits, having only small residual series impedances. A match is now effected from the low channel receiving element *B,B* through filters *C,C* and the series matching transformer *D,D-E,E*. Reflector *A,A* has a definite effect on total impedance, and flat response is obtained only through co-adjustment of reflector spacing and positioning of the filter tap points.

Comparison of the conical type antenna and the "Q-Tee" on Channels 2-6 shows an even better average increase in signal gain (Fig. 4). The proximity coupling that produced the unusual results throughout the high channels again makes possible broadband results in the low-channel range. The "Q-Tee," fortunately, does not have the inherent limitations of the conical, as no tilting of elements is necessary with consequent degradation of the horizontal pattern. The comparative horizontal directivity patterns of Fig. 4 illustrate this difference.

For readers more familiar with electronic circuits, the explanations of Figs. 6A and 6B are presented as electrical equivalents. Tuned circuit *B* may be considered a parallel resonant source (in Fig. 6A) capacitively coupled (proximity) to like circuit *D*. Circuit *B* is representative of the low-channel, half-wave dipole *B,B* and circuit *D* that of the high-channel, full-wave antenna *D,D*. Electrically, the two are separated except for condensers

Fig. 6. (A) Electrical equivalent of the "Q-Tee" at the high and (B) low bands.



C_1 and C_2. Obviously, there is a loading effect of one circuit upon the other with a resultant lowered *"Q"* and broader frequency response. The equivalent of reflector *A,A* and director *F,F* may be neglected, as their only function is to affect the relation of individual circuit impedances, and are of a fixed value. The total function of filters *C, C* (although high impedances in this case) is to further broaden the frequency response of circuit *D* by "end loading" due to physical attachment. Matching transformer *E,E* matches the appropriate impedance Z_L (transmission line) to circuit *D*. This, of course, is for the high-frequency condition for reception of Channels 7-13.

Fig. 6B illustrates the equivalent condition for reception on Channels 2-6. It must be remembered that in this range filters *C, C* are small series impedances tapped in at a point on circuit *B* at approximately 300 ohms. The actual impedance across *C, C* is actually less than 300 ohms because of match requirements (additive) of the series impedances *C, C* and the residual shunt impedance of circuit *D*. The only function of transformer *E, E* as in the high frequency case is that of impedance balance and capacitive loading. External coupling still exists between circuit *B* and *D-E, E*, but in the low-frequency case the line connection through *C, C* lowers the *"Q"* of circuit *D*, and prevents this from operating as an independent element. It might well be asked why these circuit parameters are drawn as individual elements rather than single resistances. Since it is not intended to imply that this particular antenna combination has a standing wave ratio of 1, the predominant reactive component must be considered for impedance analysis. This affects impedance as the frequency under consideration is changed from the theoretical resonance of 63 mc. on the low-band and 195 mc. on the high-band channels.

To return to the practical aspects of antenna operation, it can be seen that compared to a standard 10-element conical, the "Q-Tee" has better average gain on all v.h.f. channels. Comparing the horizontal directivity patterns of the two, the "Q-Tee" has a sharper beam width, no major secondary lobes, and a better average front-to-back ratio. The figures given are for single bay comparison using standard RTMA testing procedures.

A further disadvantage of the conical type antenna is the inability to realize the theoretically possible 3 db increase by doubling the antenna bays. To obtain such an increase, the complete separation between the physical elements comprising the individual bays must be at least one-half wavelength at the frequency under consideration. In the case of the conical, the "fanning" of the receiving elements narrows the physical separation between the bays, and makes portions of the adjacent bays do the same work. Full gain from each bay may only be obtained when the individual pick-up area of the bays does not overlap. Overlapping or close spacing results in a reduced total area of signal acceptance and, of course, less gain. The "Q-Tee" has no "fanned out" elements, and as a result will deliver an average of 3 db gain when double stacked. An additional 3 db over the double stack is obtained when the 4-stack array is used. The "Q-Tee" is limited to near-fringe reception only in the single-bay form. Stacking allows use in fringe areas with no impairment of flat response. Horizontal and vertical directivity patterns are greatly improved by such arrangements.

The mechanical construction of the "Q-Tee" is patterned along the lines of preassembled yagi types. The elements swing out from the boom and are quickly secured by tightening the wing nuts associated with the three sections. The center insulating support blocks are molded from a bakelite derivative of polystyrene. This material is excellent from the standpoint of low moisture absorption and high mechanical strength. Fig. 1 clearly shows the neat appearance of the three different combinations of the "Q-Tee."

In summarizing the basic advantages of the "Q-Tee" over former types, we must give first priority to its all-around excellent electrical performance. Reduction in size and weight, and the elimination of attendant mechanical problems (responsible for costly callbacks) should appeal to the overworked service technician. —30—

HAMS ACTIVE IN N.W.I.

WITH the re-authorization of ham transmissions in the Netherlands Antilles, the Aruba section of "VERONA" (Vereniging voor Experimenteel Radio Onderzoek in de Nederlandse Antillen) has been reactivated.

This group, although not fully licensed as yet, is making elaborate plans for its membership. A news bulletin, to be edited by George J. Heeringa, is in preparation and will be distributed to the membership to stimulate interest in the resumption of ham activities. —30—

GERMAN RADIO SHOW

AFTER a hiatus of two years, the annual German Radio and Television Exhibition will again be held in Duesseldorf from August 22nd to 31st.

All West-Germany and West-Berlin manufacturers of television and radio receivers, facsimile equipment, and phonograph records are expected to participate in the exhibition.

Featured exhibits at the show will include new ultra-short-wave radio receivers for operation in the spectrum below 30 mc. and television receivers designed to meet the CCIR standard of 625 lines.

New types of short-wave antennas, wire and magnetic tape recorders, and a series of precision test equipment will also be on display.

The German Amateur Radio Club will man a transmitter at the exhibition and special colorful QSL cards will be sent to those reporting reception of this station. —30—

Design Curves

(*Continued from page 33*)

that this formula is empirical; it applies only to triode-type tubes operated in accordance with the values given in "Resistance-Coupled Amplifier Charts.")

$$R_o = 0.17\ \mu R_k + 5000\ (ohms)$$
$$= 0.17\ (20)\ (1500) + 5000$$
$$= 5100 + 5000 = 10{,}100\ ohms.$$

Then, since

$$R_o = \frac{1}{\frac{1}{R_p} + \frac{1}{R_g} + \frac{1}{r_p}},$$

and, in this circuit,

$$R_1 = \frac{1}{\frac{1}{r_p} + \frac{1}{R_g}},$$

then

$$R_o = \frac{1}{\frac{1}{R_1} + \frac{1}{R_p}},$$

and

$$R_1 = \frac{1}{\frac{1}{R_o} - \frac{1}{R_p}}$$

$$= \frac{1}{\frac{1}{10.1 \times 10^3} - \frac{1}{50 \times 10^3}}$$

$$= \frac{1}{(0.099 - 0.02) \times 10^{-3}}$$

$$R_1 = 12{,}700\ \text{ohms}.$$

Since R_1 is approximately $\frac{1}{5}$ R (R_p = 50,000 ohms in this example), we will use the curves of Fig. 10. R_1 in this example is the same as R_o in Fig. 10. On the curve for $y = 1$, 3 db of attenuation occurs at an abscissa value of 5.4. We may now solve for the value of condenser, C.

$$2\pi fCR = 5.4$$

$$C = \frac{5.4}{2\pi fR} = \frac{5.4}{2\pi\ (1500)\ (50{,}000)}$$

$$C = 1.15 \times 10^{-8} = 0.0115\ \mu\text{fd}.$$

We would select the nearest available value of 0.01 microfarad for C. It is desirable to use a tapered potentiometer in this case. If the usual audio taper is used, the pot should be connected so that the treble attenuation is increased with counterclockwise rotation. These component values are shown in the complete circuit for this example in Fig. 8A.

For a pentode tone-control circuit, let us use a 6SJ7 with a plate load resistor of 0.5 megohm and a grid resistor for the following stage of 1 megohm. The r_p of the pentode is so high that it may be neglected; therefore, the effective value of R_1 is equal to R_p, or one megohm. Since R (0.5 megohm in this example) is equal to $\frac{1}{2}$ R_1, we use the curves of Fig. 6. The value of R_1 is the same as R_o of Fig. 6. On

the curve for $y = 1$, 3 db of attenuation occurs at an abscissa value of 1.45.

We may now solve for C.

$$2\pi fCR = 1.45.$$

$$C = \frac{1.45}{2\pi fR} = \frac{1.45}{2\pi(1500)(500{,}000)}$$

$$C = 3.08 \times 10^{-10} = 308\ \mu\mu fd.$$

The nearest available value for C is 330 micromicrofarads. In this case a linear potentiometer will give smooth control. A complete circuit of the tone-control stage designed in this example is shown in Fig. 8B.

(To be continued)

Magnetic Tape

(Continued from page 38)

vibration would cause the needle to jump to another point in the dialogue would, of course, throw us off completely. Our tape recorder is so perfect that we never have any of those difficulties. I actually feel as if it were my very own voice I was hearing rather than a recorded version. Thanks for making it possible for us to do new ideas in the ice show business."

Another interesting application of magnetic tape recording has been brought to our attention. It is the Joint Senate and House Recording Facility installed in the Old House Office Building in Washington, D. C. Under the technical direction of Mr. Robert J. Coar, coordinator, magnetic tape recording facilities are made available to members of the Senate and House, for the government archives, and for government officials' uses in reporting progress to their constituents back home.

In the photograph (lower left) Senator Joseph C. O'Mahoney is being supplied with a copy-reel excerpted from a debate on the Senate floor in which the Senator figured. In all probability, the Senator will make copies of this tape and supply them to radio stations and civic organizations in his home state. These esteemed gentlemen frequently record commentaries for broadcast purposes. Typical is Senator Kefauver who recently recorded his 25,000th mile of magnetic tape, enough words to encircle the globe with tape!

—30—

ARKANSAS HAMFEST

THE Conway Amateur Radio League of Conway, Arkansas is sponsoring an Arkansas Hamfest Sunday, July 13th, at the 6500-acre Lake Conway, 8 miles south of Conway, Ark. on U. S. 65.

The hamfest will be picnic style and all hams in the vicinity are invited to join the festivities. Officials of the Civil Air Patrol have been invited to give a brief resume of communications activities in the CAP.

Further information on this affair is available from Joe G. Robert, WN5TIC, chairman of the hamfest committee.

—30—

PERHAPS it is time we reported, in reviewing commercially-available pre-recorded magnetic tape reels, some of the mechanical aspects of the tapes. In attempting to make it convenient for the user to play his magnetic tape programs, *A-V Tape Libraries* has introduced several unusual "gadgets," including a couple of novel and interesting packaging "tricks."

On each reel, at the center of the reel, there is affixed a 1½" diameter circular label containing the company name and trademark, and a space whereon is stamped the number of the reel, thus preventing loss or confusion. This same number is stamped on the edge of the tape box. An adhesive tab is affixed to the free end of the tape to seal it when not in use, thus avoiding loose ends. A large label is affixed to the back of the box and contains the program number, a simple explanation of the number system employed, and a list of the selections contained on that particular reel. Instructions and copyright notices are printed on the inside of the box while the box itself is of the hinged-type.

Tapes of the Month

A-V #1012 (CONCERT HALL)
Part 1. Overture to the Tempest (Tchaikowsky)
Symphony No. 6 ("Pastorale") ((Beethoven)
Part 2. Symphony No. 6 ("Pastorale") (Concluded)
Austrian Symphony Orchestra, Kurt Woss, conductor
(Available in 7.5" single-track; 7.5" double-track; or 3.75" double-track

The manufacturer claims that the fidelity of the double-track tapes is exactly the same as that of the single-track tapes, no differences being detectable either by the unaided ear or with laboratory instruments.

This particular reel has both good and bad points, musically and technically. Taking the bad points first, this critic was rather disturbed by the performance of the Tschaikowsky overture. Perhaps it was a matter of budget to which art was sacrificed. In this particular performance, it appeared as though the musicians were not allowed sufficient time for rehearsal to permit them to perform as a *group*. During the emotional passages, moments when there must be unison, the recording sounded like a group of soloists rather than a symphony. Very disturbing also is the microphone placement for this recording; much too much presence; too many solo microphones. The recording engineer is to be condemned for over-use of solo-presence microphones, but is to be commended for his control of the levels and balances. The Beethoven performance is adequate. The recording, from the standpoint of fidelity and distortion, is wonderfully

clean. Thanks are due the tape duplication engineer for allowing a generous length of leader tape on this one.

A-V #1013 (CONCERT HALL)
Part 1. Symphony No. 2 in D Major, Opus 73 (Brahms)
Austrian Symphony Orchestra, Hans Wolf, conductor
Part 2. Symphony No. 2 in D Major, Opus 73 (Brahms) (Concluded)
Overture to Ruy Blas (Mendelssohn-Bartholdy)
Austrian Symphony Orchestra, George Singer, conductor
William Tell Overture (Rossini)
Austrian Symphony Orchestra, Kurt Woss, conductor
(Available in 7.5" single-track; 7.5" double-track; or 3.75" double-track)

Those of us who consider Brahms a "must" in our library of musical recordings will delight in these two recordings. The recording engineer masterfully blended the strings and bass, making the *piano* passages sweetly comforting to the listener, disarming him so effectively that the *forte* passages which quickly follow exert a swift emotional impact, as I am sure the master, Brahms, intended them.

A-V #1014 (CONCERT HALL)
Part 1. Concerto for Piano and Orchestra No. 20 in D Minor, K 466 (Mozart)
Salzburg Mozarteum Orchestra, Fritz Weidlich, conductor and soloist
Part 2. Symphony No. 4 in C Minor ("Tragic") (Schubert)
Austrian Symphony Orchestra, Kurt Woss, conductor
(Available in 7.5" single-track; 7.5" double-track; or 3.75" double-track)

For some reasons, this one differs from the others in fidelity. It is so heavy with bass that it required roll-off during the playback. However, I fear that the tape was recorded close to magnetic saturation with resultant distortion. Lots of audio level on this one—but distorted. As for the performance, the piano solo passages are truly excellent. The artist, Fritz Weidlich, performs with true dexterity and understanding of Mozart. The Salzburg Mozarteum Orchestra, under his direction, has captured the Mozart mood. Note that, if you are building your library with the "A" series, Parts 1 and 2 are on separate reels and if you do not want both of these works, you can obtain them separately since they are each complete on one reel.

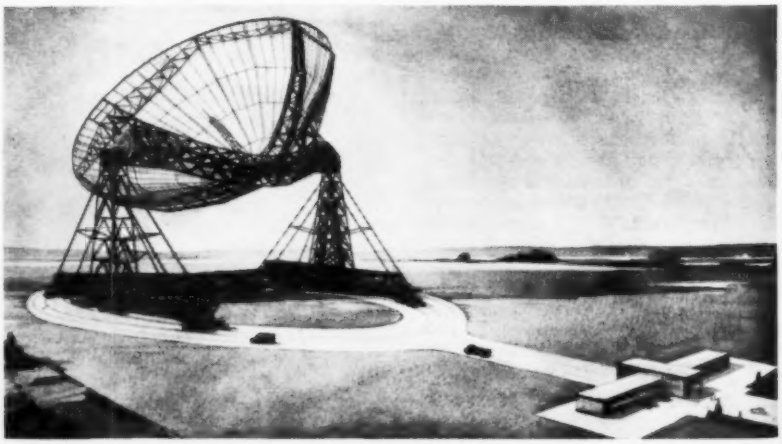
A-V #1015 (CONCERT HALL)
Part 1. Concerto for Violin and Orchestra in D, Opus 35 (Tchaikowsky)
Austrian Symphony Orchestra, Kurt Woss, conductor, Michele Auclair, violinist
Part 2. 1812 Overture, Opus 49 (Tchaikowsky)
Les Preludes (Liszt)
Austrian State Symphony, George Singer, conductor
(Available in 7.5" single-track; 7.5" double-track; or 3.75" double-track)

This is one of the better reels (speaking only of Part 1). The recording quality is both technically and musically superb; however, something went wrong with Part 2. The copy received for review was full of "wow" or "flutter," making the listening quite uncomfortable. It is gratifying to know that the critic is not receiving specially-selected reels for review. Perhaps mine was a "lemon."

A-V #1016 (CONCERT HALL)
Part 1. Symphony No. 7 in A, Opus 92 (Beethoven)
Austrian State Symphony, Kurt Woss, conductor
Part 2. Symphony No. 7 in A (Concluded)
Concerto for Violin and Orchestra, No. 1 in D, Opus 6 (Paganini)
Austrian State Symphony, Kurt Woss, conductor, Ivry Gitlis, soloist
(Available in 7.5" single-track; 7.5" double-track; or 3.75" double-track)

This reel contains the best microphone pickup placement of all the reels reviewed this month. In addition to the pleasant, full tone achieved, this reel also contains the widest dynamic range of all those yet heard. It is characteristic of the others that the engineer "rides gain" just a bit too closely, not taking as much advantage of his recording medium as he can. However, this one is much better. Perhaps another engineer was assigned to this particular recording job. —30—

An artist's sketch of the "steerable" radio telescope which will be built for Manchester University at Jodrell Bank, Cheshire, England. Costing the equivalent of $940,800, the new unit will have a parabolic dish 250 feet in diameter, and will measure 185 feet to the top of the horizontal axis. The radio telescope will weigh over 1270 tons. The new giant radio telescope, said to be the world's largest, will permit the expansion of radio astronomy techniques into more distant regions.



Eliminating TVI

(*Continued from page 31*)

At the receiver, try lining the inside, top, and bottom of the cabinet with copper screening. Ground the screen to the chassis and to a good outside ground. A low-pass filter for the a.c. power line and a high-pass filter for the lead-in will eliminate many cases of diathermy interference. In severe cases, a tuned trap, resonated at the equipment's operating frequency (and completely shielded), may help.

TYPE: Industrial Interference.

EFFECT: The general effect, as well as the remedies, are the same as for diathermy equipment.

SOURCE: Ultraviolet sterilizing or paint-drying lamps, r.f. heating equipment, neurosurgical or radiotherapy equipment, etc.

TYPE: R.F. Interference.

EFFECT: Herringbone pattern (Fig. 4) or black and white diagonal bars (Fig. 3). These may vary or change direction. If transmission is by code, the picture may flash, roll, wash out, or invert (become negative in polarity) with each dot and dash. This may also be accompanied by irregular popping noises in the sound.

SOURCES: Short-wave transmitters (FM broadcast, international short-wave, public utilities, police, mobile telegraph, point-to-point, aviation, and other emergency services).

REASON: Operating frequency or harmonic of interfering station falls within the r.f. or i.f. frequency limits of the receiver.

REMEDIES: Try installing a wave trap between the lead-in and receiver terminals, as close to the tuner as possible. Commercially-built traps may be used, but a simple ½-wavelength shorted stub or ¼-wavelength open stub (made of 300-ohm twin-lead) will usually be just as effective. Also try reorienting the antenna, rerouting the lead-in, or shifting the receiver to a different location. Shielded, properly-grounded transmission line is one answer.

TYPE: R.F. Interference.

EFFECT: Both the effect and the reason are the same as those just described.

SOURCE: Amateur radio stations. (If the receiver does not have good shielding or if it has no r.f. stage, it can pick up amateur stations legally operating in the 20, 10, and 2-meter bands. Invariably, the amateur operator is willing to cooperate with you in eliminating the interference, although his equipment may be operating properly. In a few cases, inadequate shielding or tuning adjustments at the station are to blame. If properly notified, the amateur will be glad to correct it.)

REMEDIES: If you are able to identify the signal by call-letters or by checking with hams in the community, contact the amateur and explain the difficulty. In most cases, shielding the

receiver or installing a wave trap will cure the trouble. Readjustment and installation of harmonic filters at the transmitter will usually clear up the interference if it is originating there.

NOTE: On many occasions, amateur stations are blamed for interference which actually is caused by other short-wave services. If the interference is not readily located, check in the neighborhood or community for mobile telephone or governmental relay stations, or transmitters operated in military reserve training centers.

TYPE: FM Receiver Radiation.

EFFECT: Similar to that caused by oscillator radiation from TV receivers (Figs. 1 to 5) but usually affecting only Channels 5 and 6.

SOURCE: Local oscillator radiation from a nearby FM receiver.

REASON: 2nd harmonic of FM oscillator falls within the affected channels.

REMEDIES: Same as that for TV oscillator radiation. (A piece of 300-ohm twin-lead, cut as a quarter-wavelength section of the FM oscillator's frequency and used as an open-stub wave trap, sometimes will eliminate this trouble.)

TYPE: Co-Channel Interference.

EFFECT: "Windshield-wiper" effect (picture from the interfering station continually moves back and forth, sometimes up and down, behind the desired station's picture.)

SOURCE: Another TV station operating on the same channel.

REASON: The interfering signal is noticeable when its strength is 1 percent or more of the desired station's strength. Movement is caused by slight differences in blanking and sync signals at the two stations.

REMEDIES: Reception of either station can be extremely difficult, especially if the customer lives in a weak-signal area about half-way between each station. Try a yagi, "Radarray," "Para-con," "Double-V," or other similar directional antenna and adjust carefully for maximum rejection of the undesired station. If both stations are desired, install a rotator.

NOTE: This type of interference is sometimes possible between two strong local stations operating on different channels. In this case, try a wave trap or check the i.f. trap adjustments (one of these may be defective or misadjusted).

TYPE: AM Broadcast Station Interference.

EFFECT: Black horizontal bars (Fig. 1), vertical bars (Fig. 2) or mesh (Fig. 5). If the interfering signal is strong enough, the video signal may invert or blank out entirely.

SOURCE: Nearby AM broadcast transmitter.

REASON: AM frequencies are included in the video i.f. passband. Powerful local stations may ride through if their signals are sufficiently strong, are not trapped out, or if the receiver is not adequately shielded.

REMEDIES: If the trouble appears suddenly, try to identify the station by

call-letters or by the program. (This is sometimes possible by varying the fine-tuning control.) Then report the trouble to the chief engineer or engineering department. (While the trouble may be in the receiver, it may also be due to temporary trouble at transmitter. A check might save unnecessary work for you. If the interference is due to some change in the receiver or has always been present due to the receiver's proximity to the transmitter, install a wave trap in the lead-in (as close to the tuner as possible). Use a parallel-resonant trap (range 540-1600 kc.). Shielding here is extremely important. (If interference is very strong, shield the bottom of the TV chassis and possibly the r.f., i.f., and video amplifier stages. Copper screening or aluminum foil is best for this purpose. Make sure the screen makes good, firm contact with the chassis. In extreme cases, line the entire cabinet with copper screening. (This will often relieve or eliminate interference coming from *several* different sources.)

TYPE: R.F. Interference.

SOURCE: High-power police stations operating in the 45 mc. band. Receivers using 45 mc. i.f. frequencies will be wide open to interference from this source when and if these services are placed in operation.

REMEDIES: These will have to be worked out with one or more of the remedies just described. A combination of directional antenna, shielded lead-in, proper grounding, etc., may be required.

Interference similar to that described in this article can also be caused by conditions *inside* the receiver. These and other similar types should not be overlooked. -30-

TEST TAPE USE

By J. GORDON HOLT

FOR maximum high frequency response from a high-quality tape recorder, plus the assurance that its tapes will play back equally well on another machine, it is essential that the slits on both the record and playback heads be exactly at right angles to the direction of tape travel.

Therefore, whenever the record and playback heads have been removed from the recorder they must be realigned with the tape when they are replaced.

A test tape that greatly simplifies this adjustment may be made by recording a 15,000 cycle signal on a tape, using a new full-track machine on which the heads may be trusted to be in precise alignment.

To adjust a replaced playback head, the test tape is played through the head and the adjustment is made for maximum output from the head.

The record head may then be aligned by recording a 15,000 cycle tone onto another tape and using the output level from the previously aligned playback head to adjust the record head.

If the recording head is not putting the signal on the tape in such a way that it passes the aligned playback head exactly at a right angle there will be a definite loss of high frequencies. -30-

Broadband Converter

(*Continued from page* 41)

pressor alternately cuts off and increases the current to reach the plate of the 6AS6 while scarcely affecting the cathode current controlled by the first grid and screen grid. This results in the signal being mixed only in the plate circuit because it is driven into the nonlinear portions of the plate current curve. As the plate and screen currents are 180° out-of-phase, doubling of the conversion transconductance occurs merely by placing a tuned circuit between the plate and screen, because the action of the suppressor grid causes the plate and screen currents to rise and fall 180° out-of-phase at the oscillator frequency. A negative variation of the suppressor grid causes a decrease in plate current and an increase in screen current, due to electrons turned back to the screen, and *vice versa*. Thus, effectively, a push-pull circuit exists which will give twice the conversion gain.

It is obvious, then, that a special tube must be used for the mixer. In the discussion of this circuit in other publications, a subminiature *Sylvania* #5636 was indicated for use for this service. Very few tubes have suppressor grids which will control the plate current to any extent with reasonable potentials. For this reason the *Sylvania* tube was investigated but at the present time it is available only on defense priority. Tubes with fairly good suppressor grid characteristics are available in the G, GT, and larger dimensional envelopes, but these were not deemed practical.

An investigation was made of the 6CB6 and other miniature pentode tubes of that type with negative results. Suppressor potentials as high as 45 volts had negligible effect. The fact that the 6AS6's net price is close to four dollars is a deterrent to the modification of the converter, but results seem to indicate that the expense is fully justified. The 6AS6 has about a 3 ma. plate current change for a 3 volt d.c. suppressor grid change under normal operating conditions. This represents roughly a 50% change of plate current for a small change of suppressor voltage. A negative 15 volts on the suppressor is required for complete cut-off.

For ten-meter operation where the mixer suppressor grid is driven by an amplified harmonic, there isn't sufficient voltage to drive the suppressor grid. For this reason a resistor is used in the suppressor grid ground return. This takes advantage of suppressor grid current drawn on the positive oscillator r.f. cycle, causing greater grid voltage swing. An r.f. choke *cannot* be used, except possibly on frequencies at which the plate section of the 6AG5 is also operating on the fundamental crystal frequency. In this case sufficient r.f. oscillator voltage exists permitting the substitution of a 2½ mhy.

r.f. choke. Operating the suppressor grid at zero d.c. bias rather than grid-leak bias results in a greater g_m and conversion transconductance, but sufficient oscillator voltage must be impressed to swing the plate current into saturation. The exact value of the r.f. oscillator mixing voltage, under load, is not critical, but should exceed ten volts. This has been provided in the converter design.

Practically no trouble was encountered by the builders of the three previously presented converters. Where trouble was encountered it almost always can be traced to the section involving the 472-UA coil. Coils of the "-UT" type, or those of other manufacturers were used by the experimenter with the result that there was either excessive broadcast leakage or inferior performance. To the author's knowledge *there is no substitute for this coil.* Interstage broadband coils, used in some receivers, are not satisfactory because the high impedance primary (used as a secondary) cannot match the broadcast receiver antenna input, acting instead as an r.f. choke and causing broadcast leakage.

The supply voltage for the converter is not critical. Laboratory tests made with a one-tube oscillator, the converter, and a HQ-129X receiver indicated that the supply voltage could be varied from 100 to 250 volts with but little effect on the conversion gain, and no noticeable effect on the conversion output frequency. However the 6AS6 is rated at a maximum of 140 volts on the screen, so it is advisable to use a 150 volt plate supply.

In accordance with several suggested designs, such as using a center-tapped output coil between the plate and screen of the 6AS6, the *J. W. Miller Company* was kind enough to make two such coils #9769-UA-1, and #9769-UA-2. It was expected that better conversion might be obtained, but actual experimentation indicated that the 472-UA was superior. It was noted that when using the push-pull output coil the circuit would break into oscillation. Examination of the circuit showed its similarity to a Hartley oscillator. Stable action could only be obtained with lowered gain or shielding, etc., and the best results were not as good as with the simpler untapped coil arrangement.

The photographs of the converter may make it appear more complicated than it is. This is because additional equipment, not required for converter operation, was mounted in the same box. An antenna switch was added for transmitter operation, and to allow simple selection of the broadcast radio for either SWL or BC service. The antenna switch can be of the double-pole, tone-control type when a transmitter is not to be used in conjunction with the converter. Here it is used for antenna switching, converter and transmitter filament switch, and as a safety to prevent the transmitter high voltage from being applied until filament voltage is applied. —30—

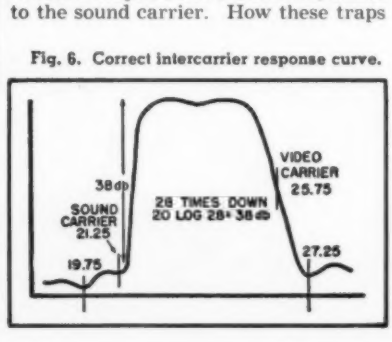
Intercarrier Sound

(*Continued from page* 37)

here, a single-coil i.f. amplifier is used, although some receivers feature transformers in either the grid or plate circuit. Transformers have some advantage in giving voltage step-up, thus providing more grid driving voltage. This is especially useful in the take-off from the second detector. The detector load is quite low and a good step-up ratio will give much higher voltage to the i.f. grid. In Fig. 5 this take-off circuit uses a simple 5 $\mu\mu$fd. coupling condenser, C_2, and the 4.5 mc. tuned circuit L_2-C_3. The video peaking coils L_1 and L_2 are designed to reject the 4.5 mc. sound i.f. signal. Variations of this circuit are included in the new *Emerson* design which features a video peaking coil and sound take-off transformer in a single unit.

Under the shortcomings of intercarrier receivers we listed the restricted picture i.f. bandwidth often found in older sets. Later we showed how intercarrier operation permits shifting the picture carrier to the top of the i.f. curve and thus adds contrast on very weak signals. There is one more important consideration in the picture i.f. response curve which affects the intercarrier system. That is the relative gain of the picture components and the sound carrier. Calculation and experiments show that the AM content of the 4.5 mc. sound signal will be very high unless the sound i.f. carrier, usually at 21.25 mc., is at least 38 db below the flat portion of the i.f. response curve. If the sound carrier is maintained below that level, AM interference such as buzzing will not be a problem. Fig. 6 shows the proper i.f. response curve which promises no buzzing in an intercarrier system. The 21.25 mc. sound i.f. carrier is 38 db or 28 times down from the top. A simple way of checking this in a receiver is with a signal generator having a calibrated output. Note the amount of signal required to give one volt d.c. at the detector at a frequency near the flat portion of the curve (approximately 23 mc.). When tuning the generator to the sound i.f. carrier frequency it should be necessary to put in 28 times as much signal to get a 1 volt reading. To achieve this 38 db step at the sound carrier most new designs feature one or more traps in the i.f. section, tuned to the sound carrier. How these traps can be aligned simply and accurately is shown in the following section on alignment.

Fig. 6. Correct intercarrier response curve.



Simple Alignment Procedure

Many service technicians realize the difficulty of using a 4.5 mc. generator for aligning the intercarrier sound section. Inaccurate generators, drift, dial errors, etc., all tend to prevent accurate alignment. Yet the TV transmitter sends out the sound and picture carrier at exactly 4.5 mc. apart and there is no fine tuning or other simple adjustment in the receiver to compensate for poor alignment. The picture i.f. alignment is never quite so critical and errors of less than ½ mc. can be compensated with the fine tuning or local oscillator adjustment. For the purpose of this discussion let us assume that the picture i.f. curve is approximately correct and the traps for the sound i.f. carrier set close to the correct sound i.f. frequency. Now it remains to align the 4.5 mc. sound i.f., limiter, and ratio detector and to retouch the sound i.f. traps accurately. To do all this we need only a v.t.v.m. and a fairly good signal from a TV station. First connect the positive lead of the v.t.v.m. to a ground near the limiter tube. Then connect the negative lead through a 220,000 ohm resistor to the grid of the limiter, pin #1 on a 6AU6. The 220,000 ohm resistor should be close to the tube pin to minimize grid loading. First set the v.t.v.m. to about 3 to 5 volts d.c. and tune the 4.5 mc. take-off and i.f. coils for maximum v.t.v.m. indication. During this operation the receiver should be tuned to a station and the fine tuning should be adjusted for best picture, regardless of sound. The limiter grid voltage may go up to 10 or 15 volts, depending on signal strength. After the 4.5 mc. coils are adjusted for maximum, readjust the sound i.f. traps for minimum reading on the v.t.v.m. These traps should need only slight corrections; if more than two or three are required, the picture i.f. curve should be re-examined.

Next connect the positive lead of the v.t.v.m. to a ground near the electrolytic condenser in the radio detector circuit (C_{14} in Fig. 5) and connect the negative lead, through the 220,000 ohm resistor, to the negative terminal of the electrolytic condenser. Now adjust the plate coil of the ratio detector for maximum v.t.v.m. reading. Since this reading may reach up to 30 or 50 volts, be sure to switch scales when moving the v.t.v.m from the limiter grid. In many receivers the plate or primary coil of the ratio detector transformer can is tuned from the bottom and unless you know definitely which adjustment is top or bottom start with the bottom slug. After tuning for maximum v.t.v.m reading, move the negative lead of the v.t.v.m to the sound output terminal, the junction of R_9 and C_{14} in Fig. 5. Now the v.t.v.m. may read either positive or negative voltage. Adjust the ratio detector secondary, the top slug in many receivers,

until the v.t.v.m. reads zero. A slight turn in one direction should result in negative voltage while in the opposite direction positive voltage should be read. Be sure and make this adjustment very carefully. If it appears impossible to bring the v.t.v.m through zero and both a strong positive and negative voltage, chances are you have adjusted the wrong slugs on the ratio detector can. Repeat adjustment for maximum voltage at the electrolytic condenser, using the other slug now. When proper zeroing is achieved, connect the v.t.v.m. back to the electrolytic and again adjust the primary. Then recheck the zero adjustment. In most ratio detectors the adjustment of either primary or secondary will have considerable effect on the other coil.

Once the ratio detector is correctly aligned there should be no need to touch up any of the other circuits. If they are readjusted, however, be sure to return the v.t.v.m. lead to the limiter grid. It is not possible to accurately align any circuit preceding the limiter by using the voltage in the ratio detector as indication.

To align the 4.5 mc. rejection trap in the video amplifier without instruments is often possible only with a reasonably strong signal. Tune the trap first for minimum inductance, *i.e.*, with the slug out of the coil area. Then adjust the fine tuning or oscillator so that the fine grain 4.5 mc. interference becomes visible. Now turn the trap tuning slug inward until the 4.5 mc. interference disappears. Retract it slightly to let it re-appear and then turn it just enough to remove the interference. Turning it further inwards will reduce the video response curve and result in loss of fine detail.

Conclusion

Now that the shortcomings of earlier intercarrier systems have been resolved and great improvements in receiver performance have been obtained, most TV manufacturers will use this system. As a matter of record, practically all major manufacturers feature the improved intercarrier system in their current models. The 1952 *Philco, RCA, Admiral, G-E, Emerson, Westinghouse,* etc., models are all intercarrier receivers and can be adjusted and aligned as described in this article.

—30—

"Joe, I want you to meet our architect; he used to design dry-plate rectifiers!"

Mac's Service Shop
(*Continued from page 61*)

"Okay, why did they make the lines 450 ohms? Why not make it 300 ohms so it would match most existing antennas and receivers?"

"If the line were reduced to the spacing necessary for 300 ohms, the capacitive losses would render it useless as low-loss lead. The only advantage it would then have over ordinary twin-lead would be the difference in the dielectric losses, and this would probably be offset by the effect of slight irregularities in spacing that would cause more difficulty when the wires were closer together.

"The 'free space' line loss goes down with increasing impedance up to the point where line radiation becomes appreciable; so it might seem that it would be a good idea to make the impedance of the line much higher, say up to 1000 ohms. There are, however, several good reasons for not doing this: first, the increased spacing would make the line bulkier and harder to handle and support; secondly, the field about a wider-spaced line would be more intense, and this would mean it would have to be kept farther away from other objects if losses were to be avoided; thirdly, as the spacing was increased, the tendency of the line to pick up noise would increase; and finally, the one-inch spacing of 450-ohm line seems to be a good compromise because its impedance is so close to that of ordinary 300-ohm twin-lead that, in most cases, the two can be used interchangeably."

"How about that? Can you just ignore the fact that you are using a 450-ohm line to connect a 300-ohm antenna to a 300-ohm TV receiver?"

"In most cases, yes. After all, that is only a mismatch of 1½:1, and a mismatch of 2:1 can be withstood without serious defect. One thing you must keep in mind is that the receiver and the antenna have a 'nominal' impedance of 300 ohms. Actually, they may vary widely from this figure. If it happens that the receiver impedance is substantially below 300 ohms, then the use of a 450-ohm line may result in a noticeable loss of signal or even bad standing waves on the line."

"What do you do about that?"

"Match the impedance of the line to the nominal impedance of the receiver. If you are only interested in receiving one TV station—and in many areas, that is all you can get—matching the impedances can be done by means of a quarter-wave matching transformer. Such a transformer is just a length of line that is a quarter wavelength long at the frequency being received and that has the proper impedance to act as a transformer from the 450-ohm line to the 300-ohm receiver."

"What would that proper impedance be?"

"The impedance of the quarter-wave section should be equal to the square

root of the product of the two impedances being matched. In this case that would be the square root of 300 times 450 or, u-m-m-m-m—" he hesitated as he manipulated the slide rule, "about 368 ohms. Since the impedance of an open line is simply a function of the size of the conductors and the spacing between them, it is no big job to make up such a transformer from the impedance charts given in any good handbook."

"What if you want to match the 450-ohm line to a 50- or 75-ohm input?"

"Those lower inputs are usually intended for coaxial lines; so the problem is not just one of matching impedances, but you also have to convert from a balanced to an unbalanced line at the same time. The device known as the 'balun' is the ticket for that, and the March, 1952, issue of the technical section of *'Sylvania News'* contains complete constructional information on making such a gadget for matching 450-ohm line to either of those unbalanced impedances you mentioned," Mac said as he slid a paper across to Barney.

The youth looked it over casually for a few seconds and then said:

"You say the quarter-wave transformer is all right for one frequency when going from 450 to 300 ohms, but what if you want to receive several TV stations widely separated in frequency?"

"Then a tapered-line transformer is the best answer. In fact, it is probably the best answer in any case. Such a transformer is simply a section of transmission line in which the spacing between the conductors changes in a linear fashion from a spacing that would be right for the higher impedance down to a spacing that is correct for the lower impedance. The 450-ohm line is connected to the wide end, and the 300-ohm line or the receiver input is connected to the narrow end of the tapered line. A wave traveling through this tapered section has its voltage-current ratio gradually transformed in accordance with the change in characteristic impedance, and so there are no reflected waves produced."

"How long does that tapered section have to be?"

"That depends upon the lowest frequency you want to receive. *Terman* says that the tapered line will give almost perfect impedance transforming action from very high frequencies down to a frequency at which the length of the tapered section is about a wavelength. At lower frequencies, particularly when the tapered section is less than a half wavelength, the tapered section becomes an abrupt change in impedance and standing waves are set up. The exact point at which this unfavorable condition becomes serious depends somewhat on the ratio of the impedances being matched. At a 2:1 ratio, the critical length of the tapered section is between one-half and a full wavelength. As the ratio becomes smaller, the tapered section can be

shorter without increasing the standing waves; and since we are matching impedances with a ratio of 1½:1, that is in our favor."

"Can you buy a tapered line transformer?"

"Yes. *RMS*, for one, makes such a transformer and recommends that it be tried both at the antenna and receiver when installing 450-ohm line. When a noticeable improvement results, it should be left in; but if no change can be seen, it can be omitted."

"How about making your own? Some of the guys have told me that they just split twin-lead for about a foot and fan it out to meet the spacing of the 450-ohm line."

"From what I have just told you about the minimum length of the tapered section, I doubt if that practice is a good one, especially for the low-frequency channels. *Gonset* recommends that you remove five spacers from the end of their line by snipping the spacers with diagonal cutters from the back parallel to the wires. Then cut the wires to exactly thirty inches from the last spacer. Strip and splice to 300-ohm ribbon, using solder or *'Stakon'* solderless connectors. Keep the tapered section taut by mounting in such a manner that tension is kept on this section and twisting is prevented. They say this results in a very efficient tapered line impedance transformer."

"How do you support the 450-ohm lead-in?"

"Use regular stand-offs where the line goes down the mast or the side of a building. The spacer is slipped into the opening of the grommet intended for coax, and then if necessary the ring is pinched tight with gas pliers. Care should be taken to see that the ring is evenly spaced from each of the conductors. Where you have long horizontal runs, say across a ravine or down the side of a hill, *RMS* makes and recommends a spring-type stand-off for keeping an even tension on the unsupported span. *Gonset* suggests that if spans of more than 150 feet (or 100 feet when icing or strong winds are present) are used, the line be supported by a galvanized steel messenger wire, with the line at least six inches below it. When you want to turn a corner, you turn the line up on edge with a 90-degree twist and support it vertically at the end.

"Keeping in mind that a higher impedance line has a larger field around it, at least seven-inch stand-offs should always be used, and care should be taken to see that the line stays well clear of gutters, downspouts, and other metallic objects."

"How do you get the line into the house?"

"You *could* saw two ditches in the window frame, lay the wires in these, and then fill the cuts with plastic wood; but a better system is to use a tapered line transformer just at the point where the line is to enter the house and then come on in with regular 300-ohm ribbon. Since the rib-

bon will be inside, out of the weather, any losses it adds will be negligible."

"What if the antenna is a rotating kind? You can't go wrapping that 450-ohm lead around, can you?"

"No, but in a new installation you could use a motor of the sort that carries the antenna connections through the rotating mechanism on slip rings. Otherwise, the best thing to do would be to again use a tapered line transformer right at the top of the tower and then go from that point on up to the antenna with a good quality twin-lead that will withstand flexing. Since this twin-lead section will be short, it will not add very much loss, even in foul weather."

"Do you twist the line coming down the tower?"

"Mr. Smith of *Gonset* says that from the standpoint of theory and actual tests, there is no point in twisting the line to reduce noise pickup—something I've been suspecting for quite a while. As a matter of fact, transposing any balanced line precisely every half wavelength will actually increase the noise pickup broadside to the line."

"How long a run do you think it takes to make using 450-ohm line worthwhile?"

"On the v.h.f. channels, and under conditions of dry weather, and considering *only* the signal loss, it would probably not be worthwhile to use 450-ohm line for a length less than 100 feet. But when you consider how sharply the loss of ribbon line goes up when it gets wet, and when you consider the permanence of the open wire line, it can easily be worth-while even on shorter lengths. This is especially true where sea coast salt or industrial area soot quickly impairs the initial efficiency of ribbon lines.

"And now that we have to start thinking about u.h.f. installations where transmission line losses really become serious, I am confident installers are going to turn more and more to the 450-ohm open wire line."

"It figures," Barney agreed as he smothered a prodigious yawn and slid from the bench. "And on top of that Margie, my one-and-only, says she thinks they are cute because they remind her of little ladders that the TV signals can use in climbing down from the antenna!" —30—

GRAPH PLOTTING AID

By JAMES R. FORD

A TRANSPARENT celluloid sheet (or other plastic such as the 8½" x 11" acetate clear-view, loose-leaf sheet protectors) fastened securely to a tube characteristic or other "working" graph provides a handy, rapid, and neat method of utilizing the graph.

By using grease pencils, of various colors if desired, to scribe load lines, or other useful information on the transparent sheet, it is possible to get full use of the graph without having to be careful not to spoil the original. By simply wiping off the transparent sheet with a blotter or cloth, it is possible to use the same graph over and over. —30—

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

BBB-RTMA BOOKLET

The Association of Better Business Bureaus and the Radio-Television Manufacturers Association have jointly announced the publication of a booklet providing basic information necessary for purchasers or owners of television receivers.

The new 11-page booklet is a revised edition of a booklet which was originally issued by the BBB in New York. The revised edition, entitled "Things You Should Know About the Purchase and Servicing of Television Sets," was prepared by the RTMA Service Committee in cooperation with the Television Service Committee of the BBB.

Written in non-technical language and slanted for the layman, copies of this booklet are now available from Better Business Bureaus and from various retail television dealers throughout the country.

ELECTRICAL TAPES

Insulation Manufacturers Corporation, 565 West Washington Boulevard, Chicago 6, Illinois, has just issued a 16-page catalogue giving detailed information on characteristics, uses, and technical data on "Permacel" pressure-sensitive electrical tapes.

Cotton cloth, crepe paper, flatback paper, acetate cloth, acetate film, acetate cloth film combination, and vinyl film electrical tapes are covered in the catalogue. Some of these tapes are of the heat curing type for heat and solvent resistance.

A special section is devoted to non-electrical paper, cloth, glass-reinforced paper, cellophane, and acetate fiber tapes.

Copies of this catalogue may be obtained free of charge from the Publications Department of the company.

TERMINAL DATA

Triad Transformer Manufacturing Co., 2254 Sepulveda Blvd., Los Angeles 64, California, has issued a new catalogue covering its line of single and multiple terminals.

The catalogue, which has been designated as the TH-52, contains full-size illustrations, specifications, and dimensional drawings, plus recommended installation procedure, general information, and several typical installation applications.

Copies of TH-52 are available without charge to those making their requests direct to the company.

TV ANTENNA GUIDE

Channel Master Corporation, Ellenville, N. Y., has issued a new 12-page booklet which describes more than 50 different types of antennas, accessories, and kits.

Entitled "Your Guide to *Channel Master* Television Antennas," the two-color booklet is concise and easy-to-read. It describes the specific reception problems that each antenna is designed to solve. It lists the latest types of antennas in the company's line including the new 10-element impedance-matching yagi.

Every item described in the catalogue is fully illustrated with gain curves; polar diagrams are included for many of the antennas. Copies of this new publication are available to installation and service technicians without charge.

NEW CONNECTORS

An 8-page catalogue which describes the company's line of compact connectors for electronic and aircraft use has been released by *Hugh H. Eby, Inc.,* 4700 Stenton Avenue, Philadelphia, Pa.

Included in this new publication are dimensional drawings, and a detailed description of male and female rack and panel connectors having 3, 4, 7, 8, 11, 14, 15, 18, or 34 pins; miniature 5, 7, and 9 pin connectors; and watertight and universal binding posts.

A copy of "Catalogue Supplement No. 1" is available without charge upon request to the company.

DRY TRANSFORMERS

Magnatran Inc., 248 Schuyler Avenue, Kearney, New Jersey, has issued a new 4-page bulletin covering its line of indoor and indoor-outdoor dry type transformers.

The newly-designed transformers described in the publication incorporate easy-to-install features and meet all standards such as the AIEE, ASAMEMA, and UL. Ratings listed are 600 volts and below, single phase, 3 kva. to 200 kva.

When requesting copies of this catalogue, please specify No. 6-01.

MOUNTING DEVICES

T. R. Finn & Co., Inc. of 333 Jackson Avenue, New York 54, New York, now has available a 4-page illustrated bulletin covering its line of airborne electronic mounting bases, vibration isolators for these mounting bases to JAN-C-172A specifications, Type M shock mounts for Signal Corps specifications, and fire control shock mounts for naval vessels.

The section dealing with airborne mounting bases has explanatory diagrams with complete detailed specifications for all sizes and uses. Com-

plete load ranges are shown for the vibration isolators which are used in conjunction with the airborne mounting bases.

The section on shock mounts for Signal Corps equipment or naval vessels also has explanatory diagrams covering specifications and technical characteristics.

When requesting a copy of this bulletin please specify Catalogue MB-110.

"HOW TO SOLDER"

The *Federated Metals Division* of *American Smelting and Refining Company*, 120 Broadway, New York 5, New York, has published a new 16-page booklet on the fundamentals of soldering.

Entitled "How to Solder," the little booklet contains simple instructions and illustrations designed to make soldering better and easier. Since the strength of the soldered joint depends on the type of solder and the soldering method used, the booklet covers every step from the choice of alloy through the application of the solder.

The booklet is available without obligation from the company direct.

SPEAKER INDEX

The Tube Department of *Radio Corporation of America* has issued a novel flip-type index which is designed to place basic electrical and mounting information on *RCA* radio and television speakers at the fingertips of service dealers.

This handy, compact index, which is less than six inches square, provides all the data necessary for the installation of any one of 22 different *RCA* speakers. The index can be mounted on a wall or atop a service bench.

Each of the 22 speakers listed is illustrated by a physical outline drawing and a halftone photograph. The necessary mounting information and such basic electrical data as voice-coil impedance, power-handling capability, resonant frequency, and magnet weight, are also included.

The index is available to radio and TV service dealers and service technicians through their *RCA* electronic components distributors.

CONTROL BULLETIN

Wirt Company, 5231 Greene Street, Philadelphia 44, Pa., now has available for distribution copies of its Bulletin #177 which describes the company's complete line of wirewound potentiometers, wirewound rheostats, and slide switches.

The bulletin gives all pertinent details on potentiometers and rheostats rated at from 3 to 5 watts, made with bakelite housings in values from 5 to 100,000 ohms, and supplied with shaft and bushings as may be required. Also covered are potentiometers and rheostats rated at from 1.5 to 2 watts with metal housings and bushings or with slotted rotors and rivet mounting.

The company's line of slide switches for radio and television receivers, phonographs, and instruments is also described in detail. —30—

Ranch Radio

(*Continued from page 29*)

Hooking up ranches and isolated towns with the rest of the world is a dramatic use for radio—but in the West there is still another need. Some ranches are so big that communication between various parts of the ranch itself is a king size problem and ranchers are turning to radio for this purpose, too.

In Southern Wyoming there is a big spread which has "gone radio"—the Wyoming Hereford Ranch. This beautiful ranch, which reminded the writer of the spic-and-span thoroughbred horse farms near Lexington, Kentucky, was once privately owned. Now it is held by a three-man trusteeship—and the profits go to a religious institution.

The ranch covers about 65,000 acres, and is still growing. The "heart" of the ranch is a cluster of white houses and red barns along a stream. The offices where visitors are received—and thousands of visitors have parked their cars and walked around the landscaped grounds—are as business-like and efficient-looking as a manufacturing plant or wholesale firm.

But the business is raising Hereford cattle. And the WHR brand is known wherever the breed is known—because their herds are world-famed. As a matter of fact, the records of the American Hereford Association reveal that out of the first sixty-odd "Register of Merit" bulls—the highest award in the industry—ten came from this ranch.

When you see the cattle—and particularly the short-legged, curly-haired bulls (which may weigh a ton and—even to the untutored eye of a radio man—are obviously "Bulls of Distinction") you know that they receive extremely careful handling. And it is no wonder, for one of the best, the fabulous Helmsman III, was "not for sale" even though a prospective buyer offered $100,000.

Keeping this galaxy of prize cattle well-fed and well-cared-for is naturally a round-the-clock business. Orders from the main ranch often need to be transmitted in a hurry to the two outlying ranches—or to a mobile unit out somewhere on the 100 square mile ranch. To do this job—and to be ready should another crisis arise as it did about 2 years ago when a roaring grass fire threatened a part of the ranch—WHR decided to install two-way radio equipment.

The radio equipment is the kind of straightforward gear which makes a ham feel right at home. The trim transmitter at the office, operating on 43.1 megacycles, feeds a ground plane antenna. This combination puts out a healthy signal which can be picked up in every corner of the ranch. Similar rigs are installed at the outlying ranches. The mobile gear provided is very similar to that used in police radio hookups.

How does the installation work? "It

works so well that we don't think much about it," says George Lazear, executive manager of the ranch. "It saves us time and money. Guess that's about all you could ask."

But down at Kim, Colorado, where this story began, they want something else. Vic Waters, crusading editor of the *"Kim Country Weekly,"* who helped "sell" the ranchers on raising the money needed to put in the radio-linked phone system, explains it this way.

"It was a wonderful thing to have the radio and telephone system go in. It was something which we had dreamed about for years.

"But," and his eyes twinkled, "there is one thing missing. I brought the matter up at a committee meeting the other night."

"And what is that?"

"We need an 'ejector.' These women who get on the line. Sometimes it's mighty hard to get 'em off. In fact. . . ."

Women, it seems, are women, be it in the Bronx or on an isolated western ranch. Anybody know a good, simple, *diplomatic,* "ejector" circuit?

-30-

HEADPHONE BANDS

By ARTHUR TRAUFFER

WHEN cloth-covered headbands have become worn, torn, or soiled, replace them with soft natural-rubber tubing, as shown in the photo. Natural-rubber tubing is soft, sanitary, and it can be cleaned with soap and warm water, or with alcohol. Use tubing ¼" o.d., or larger, sold by hospital supply or chemical apparatus supply houses. With the type of headbands shown, it's a simple matter to remove the old covering and slip on the rubber tubes by simply removing the two small screws on one side of the frame. If yours uses rivets, file the rivets flush with the plate and drill out the rivets, or drive them out with a small punch. After slipping on the rubber tubes, reassemble the frame using rivets or small R.H. machine-screws and nuts. Some headband frames are made so that they cannot be taken apart easily. In this case, remove the old coverings with a hacksaw and razor blade, slit the rubber tubes length-wise and slip them onto the frames. Assembled in this way, the tubes do not come off easily, but if desired, you can wrap a couple of turns of transparent cellulose tape around each end of each tube and also in the center of each tube.

-30-

Replace headphone bands with rubber tubing.

Classified

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